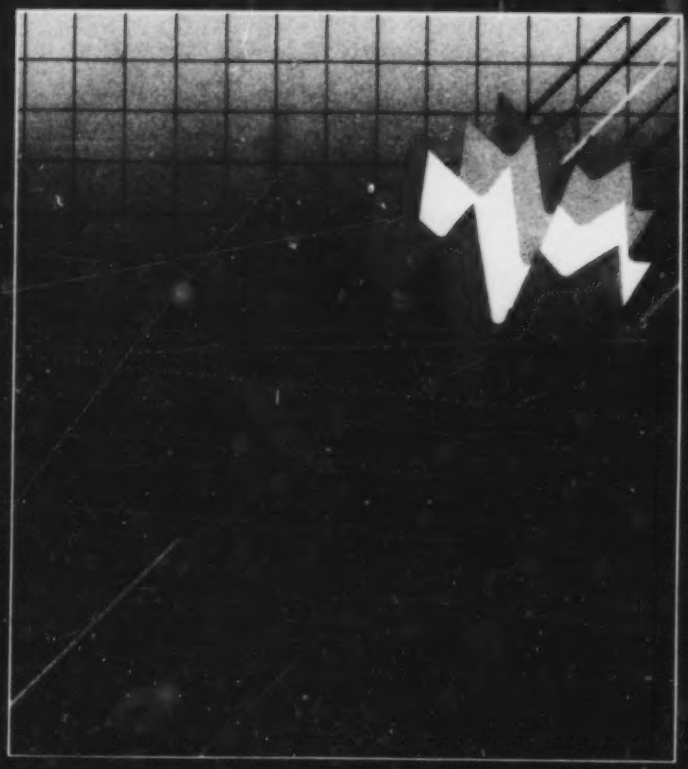
# Science and Technology

## PROVINCIAL GOVERNMENTS' BIOTECHNOLOGY EXPENDITURES AND ACTIVITIES 1985-86



Ministry of State
Science and Technology Canada

Ministère d'État
Sciences et Technologie Canada

Canada

# PROVINCIAL GOVERNMENTS'

# BIOTECHNOLOGY

# EXPENDITURES AND ACTIVITIES

# 1985-86

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## PREFACE

This report was prepared as a contribution to knowledge of the pattern of development of biotechnology in Canada. In particular it looked at biotechnology activities in provincial government agencies. Other reports have been prepared or are planned on biotechnology activity in the federal government, in industry and in the universities. While there is activity in some municipal agencies in the field of biotechnology, it was beyond the scope of this study to collect or assess information on such activities.

The author would like to thank the officials in all the provincial agencies that spent their valuable time completing the survey questionnaire. The provincial contact persons for biotechnology were especially helpful in coordinating responses from each province and in reviewing drafts of the document. As well, the assistance of the staff of the Biotechnology Unit of the Ministry of State for Science and Technology was invaluable in editing, proofreading, typing and generally encouraging this work. The guidance of David Shindler and the editing and proofreading assistance of Jessie Weldon and Ron Fletcher deserve special mention.

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## EXECUTIVE SUMMARY

This study presents information on biotechnology activities in provincial government agencies and gives some assessment of the degree of complementarity, cooperation and communication between the provinces and between the federal and provincial governments on the subject of biotechnology.

Biotechnology has been identified as a subject warranting attention by all the provincial and territorial governments. While the approaches vary from province to province, as do the ministries responsible, the main thrust in each jurisdiction is to encourage the development of biotechnology-related industries that will benefit the economy.

Federal and provincial governments have slightly different approaches to science and technology and consequently to biotechnology. The federal agencies are doing much of the basic research in the field and are aiding in transferring new technologies to industry. In many cases the provincial governments are more active in developing technology applications and funding specific research of value to local governments or industries. With the odd exception, these varying approaches have led to good complementarity between federal and provincial activities. There appears to be less success in direct communication between the two levels. Federal government departments and researchers expressed a desire to know what was being done in the provinces and provincial departments and researchers had a similar interest in federal programmes.

Spending in biotechnology is spread across the country and across a wide range of industrial sectors. Provincial biotechnology programmes accounted for about $19.7 million of spending in fiscal 1985/86, mostly by the provincial governments (89.4%). The federal government (6.1%) and industry (4.5%) also contributed to provincially-managed programmes. The majority of the spending is in four sectors: agriculture, health care, fermentation and forestry.

Provincial governments are not major employers of biotechnology researchers. Their role, as they see it, is to encourage the development of biotechnology in industry but not necessarily to perform the research. Obvious exceptions to this philosophy are the provincial research organizations (PROs) which are active in technology development. It is noted that in most cases there are fewer than four researchers working on any one project. This may be inhibiting the interdisciplinary approach that is so important in the field of biotechnology. Another possible weakness in the human resource allocations is an apparent shortage of engineers to translate the results of research into industrial processes.

Provincial governments and agencies do not have a very large demand for highly trained scientific personnel in biotechnology. They have, however, made moves to support and encourage biotechnology-related training in their universities and community colleges. There is a limited demand for personnel, especially from research-oriented agencies such as the PROs and agriculture ministries. Most of this demand is for Ph.D and B.Sc level scientists in basic fields such as biochemistry, microbiology and genetics.

Some provincial agencies have been expending resources on biotechnology-related programmes since the late 1970's, but most did not initiate biotechnology programmes until about 1982. Since that time there has been a considerable increase in the number of agencies having biotechnology activity, but only gradual increase in individual budgets. Most agencies expect spending levels to rise only slightly over the next few years. Most provinces reported significant increases in industrial activity in biotechnology in recent years.

The report concludes that improving communication and cooperation between researchers and policy makers in the various provinces and on a federal-provincial basis should be a priority. There is a recommendation that the provincial governments be able to meet on an operational basis with the federal Interdepartmental Committee on Biotechnology to discuss individual strengths, weaknesses and priorities. Planning of complementary efforts could be a result of such discussions.

## ERRATA

| | |
|---|---|
| P. 3 | As of October 6, 1986 the responsibility for the biotechnology strategy in Québec has been given to the Ministry of External Trade and Technological Development (Ministère du commerce extérieure et du Développement technologique). |
| P. 20, 21 | the labels on the numerical axes should be "$ THOUSANDS" |
| P. 24 | **Add** "Ministère du commerce extérieur et du Développement technologique, Québec" |
| P. 29 | **Substitute** Terry Prentice, (604) 387-2034 for Barry Stevenson |
| P. 88 | **Substitute** Mr. Terry Prentice<br>Director, Policy Research<br>and Information Systems<br>Science and Technology Division<br>Ministry of Economic Development for Barry Stevenson |

The address remains the same. New phone number (604) 387-2034

## INTRODUCTION

In June 1983, the federal government, recognizing the challenges and opportunities to Canadian industry presented by a new set of biology-based technologies, announced a **National Biotechnology Strategy.** The long-term objective of the Strategy was to provide policy and programme guidance to enhance scientific research and industrial applications, to encourage skilled human resource development, to foster effective collaboration and communications, and to help create an economic and regulatory climate conducive to commercial biotechnology investment and activity. The Ministry of State for Science and Technology (MOSST) was given the responsibility of implementing the Strategy.

The Strategy provided for a series of related activities including:

- the formation of the National Biotechnology Advisory Committee to advise the Minister on biotechnology in Canada and to monitor the Strategy;

- the establishment of a set of biotechnology R&D networks to foster links between the performers and users of research;

- the Program for Industry/Laboratory Projects (PILP) Biotechnology. A cost-sharing programme designed to support industry projects which involve collaborations and sub-contracts with universities or provincial research organizations; and

- the formation of a Federal Interdepartmental Committee to provide a forum for discussion of the federal government responsibilities under the National Strategy.

To fulfill the objectives of the Strategy, MOSST identified a need for more complete information on biotechnology activities across the country. In the summer of 1985 a series of surveys were initiated to determine the levels and patterns of activity in biotechnology in the federal government, the provincial governments and in industry. In each case questionnaires were circulated to appropriate officials involved in research, funding and application of biotechnology.

This report summarizes the results of the survey of provincial governments and agencies. It represents one response by the Ministry of State for Science and Technology to the critical need to foster better communications and cooperation within the biotechnology community in Canada. The information is provided in the hope that it will be useful in planning mutually supportive initiatives by the federal and provincial governments and in encouraging investment and commercial development.

Defining a rapidly developing field such as biotechnology is difficult. The definition circulated with the survey questionnaire was: **"the utilization of a biological process, be it via microbial, plant or animal cells, or their constituents, to provide goods and services."** As the data was collected, and in consultation with several of the respondents, it became apparent that a more precise definition was needed. The "biotechnology" described in this report has an accent towards new and novel aspects of biological techniques including, but not limited to: genetic manipulation, cell fusion, tissue culture, enzymes and enzyme systems, process and systems engineering and computer-aided protein design.

This survey attempted to assess the level and pattern of investment by provincial governments in biotechnology. The data that was made available, however, provided only a "snapshot" of the expenditures for the 1985/86 year. Financial data for other years was incomplete, so a thorough analysis of trends and patterns was not possible. The survey is not a comprehensive listing of all biotechnology activity in the provinces. Federal laboratories and programmes, university research projects and industrial R&D efforts not specifically supported by provincial funds are not included. As well, coverage of provincial agencies may not be complete. Although considerable efforts were made to identify all agencies involved in biotechnology, some may have been missed, and others chose not to respond.

This report provides an overview of approximately how much money various provincial agencies indicated they are spending on biotechnology, what human resources are available and what the pattern of investment is by provincial governments. In addition, it looks at comparable federal investment in the provinces and comments on the apparent complementarity (or lack of complementarity) between federal and provincial interests. The information is intended to assist in policy development both provincially and federally and to encourage cooperation, thus avoiding potentially costly duplications of effort. It will help in identifying strengths and weaknesses in Canada's biotechnology development and will provide additional information to support better federal-provincial cooperation.

While most of the information contained in this report has been gathered through questionnaires, it has been supplemented with information gathered at the National Biotechnology Advisory Committee's Edmonton Workshop (October 2, 1985) involving provincial contacts, and through reports of the regional workshops held in Saskatchewan (November 20, 1984) and Nova Scotia (July 4, 1985).

## BIOTECHNOLOGY POLICY APPROACHES

All the provinces have identified the strategic importance of biotechnology and, at the least, are making efforts to monitor developments in the field. Several have specific, formally developed policies to encourage R&D and industrial investment in key areas. Each province has unique problems and potentials related to biotechnology and the policy approaches often reflect these features.

**Québec** has an ambitious **biotechnology strategy.** Announced in 1982, it has committed $30 million over five years for research and development and venture capital for biotechnology. The focus is on three sectors: health care; agri-food; and forestry/biomass. A Biosciences Committee has been established to oversee the implementation of the strategy and overall responsibility for the strategy rests with the **Québec Ministry of Universities, Sciences and Technology (Ministère de l'enseignement supérieur, de la science et de la technologie).**

Many of the provinces, including **Prince Edward Island, Manitoba, Saskatchewan** and **British Columbia** are attempting to **integrate** their approach to biotechnology within an **overall advanced technology strategy.** Such a strategy recognizes the common threads in all the high technologies - high R&D intensity, high risk, short product life cycles, requirements for highly skilled personnel - and attempts to develop programmes that will take those factors into account. Reflecting the fact that biotechnology is multi-disciplinary and cross-sectoral, the overall responsibility for developing these approaches is divided between **science and technology ministries (Saskatchewan, B.C.), industry ministries (Manitoba)** and **development organizations (P.E.I.).**

Several of the provinces have identified **individuals or organizations to coordinate the biotechnology activities** in the province and to develop policies for encouraging biotechnology activity. This has resulted, in some cases **(Ontario),** in the formation of networks of contacts within departments potentially affected by biotechnology. In other provinces biotechnology activities are promoted through less formal channels. There appears to be fairly good communication between the various provincial departments as well as between the government and the potential industrial users of biotechnology. Not surprisingly, many of these individuals and organizations are part of **industry ministries (Ontario)** or **development ministries (Newfoundland, New Brunswick).**

The governments of **Alberta, Nova Scotia** and **New Brunswick** have transferred much of the responsibility for encouraging biotechnology to the **provincial research organizations,** which are often at the forefront of R&D in the province.

**The Yukon** and **the Northwest Territories** have very little science infrastructure. The recently formed **Science Institute of the Northwest Territories** is a first step towards dealing with scientific issues. Biotechnology is not a priority subject in the North, however the territorial governments report a desire to keep abreast of the development of biotechnology in Canada, and its potential for the future.

## FEDERAL-PROVINCIAL COOPERATION IN BIOTECHNOLOGY

**Table 1** (Major Biotechnology R&D Centres) shows some of the prominent R&D facilities and initiatives in the various regions, both at the provincial government level and the federal level. It shows some areas of complementarity between federal and provincial programmes while exposing other areas where the two levels seem uncoordinated and, in some cases, somewhat competitive.

In the smaller provinces, such as those in the Maritimes, a major portion of scientific research is done or supported by the federal government. The provincial departments are oriented towards encouraging the use of new technologies rather than developing the science base for these technologies. As well, they fund and/or perform R&D that is relevant to specific provincial needs. In this sense there seems to be good complementarity between federal and provincial programmes.

The Québec government has, in its evaluation of its biotechnology strategy, called for better cooperation with federal government agencies. With respect to the major federal development in Québec of the **National Research Council's Biotechnology Research Institute** (Montréal), federal-provincial consultations have been instrumental in avoiding duplication of facilities and in ensuring that the Institute would complement present and future provincial research and industrial initiatives.

There appears to be good cooperation between the Ontario and federal governments. Much of the R&D at the **Ontario Research Foundation** is supported under contract with the federal government and supports activities at the Environment Canada Wastewater Technology Centre and the Canada Centre for Mineral and Energy Technology. In addition, the Ontario Research Foundation is supporting related research with its own funds.

In the Prairie Region, agricultural biotechnology is highlighted at both the federal and provincial levels. The **National Research Council's Plant Biotechnology Institute** (PBI) in Saskatoon, and the **Veterinary Infectious Diseases Organization** (VIDO) at the University of Saskatchewan are foci of activity. Contracts from or to VIDO and PBI account for much of the activity in the Prairie Region. At the **Alberta Research Council**, the biotechnology pilot plant started operations in 1985 with a broad range of facilities.

The biotechnology department is now developing large scale fermentation technology that will support both federal and provincial efforts in the field.

On the basis of existing facilities and activities, there is only limited complementarity between federal and British Columbia R&D agencies. The degree of complementarity is however, expected to increase. A major initiative in forest biotechnology on the provincial side will complement federal research activities. As well, provincial activities in aquaculture biotechnology will in time complement the existing activities of the federal Department of Fisheries and Oceans. Through ERDA sub-agreements, the federal government is cooperating with the province in the development of a Biomedical Research Centre and a Biomedical Processing Plant at UBC under the auspices of the Terry Fox Medical Research Foundation.

Across the country, many of the ongoing projects at provincial agencies are jointly funded by the federal and provincial governments, which enhances the links between the two government levels. The direct links between the research agencies, however, are not as strong. In discussions at the various regional workshops, and in consultations with the various federal and provincial officials, it was apparent that officials at the provincial agencies had little idea of what work was being done at the federal laboratories, and vice-versa.

Many provinces made reference to Economic and Regional Development Agreements (ERDAs) with the federal government, and to specific science and technology sub-agreements. These agreements vary from province to province in what they cover and what sort of funding arrangements are involved. Although some sub-agreements have highlighted biotechnology, in most cases funding levels have not been sufficient to support such specific initiatives.

The information collected in the survey, and gathered at the regional workshops has indicated that while there is cooperation between provincial and federal governments on specific projects, there is little communication as to priorities, strengths, weaknesses, directions, etc. Improved communication and cooperation on overall strategies and policies could help to eliminate some duplications of effort and encourage cooperation between research teams at different levels.

## BUDGETS AND EXPENDITURES

The survey questionnaire requested spending figures that did not include salaries, basic overhead or capital expenditures. Several of the provinces (Québec and B.C. among others) did not provide figures on this basis. The figures used in this report are those furnished by the province in question. They may not have the same base.

**Table 2** and **Figure 1** demonstrate the commitments and policy decisions made by the various provinces. Québec was quick to embrace biotechnology as a key to the future and made a major commitment of funds over 5 years. Alberta has major activities, but does not at this time have a specific biotechnology strategy with a solid commitment of funds to be spent. Ontario has recently made moves to officially recognize biotechnology. They are committed to encouraging the development of industrial applications of biotechnology. The Ontario government, in a joint venture with Labatt's and the Canada Development Corporation, made a large commitment of funds in the formation of Allelix. They have a 20% equity interest in the firm, and have committed $18 million for research operations over 10 years, and a capital loan of $15 million to construct the research facilities. It is the government's feeling that further funding and activity in biotechnology should be from the private sector. Several provinces, including British Columbia, Manitoba and Saskatchewan, allocate resources to biotechnology in the context of an overall advanced technology industrial development strategy. There are no specific allocations to biotechnology, and it is the responsibility of the private sector (and other research sectors) to take the initiative to utilize government support programmes. The smaller provinces depend more on the federal government for scientific R&D. Their policies lean toward transferring new technologies to industries and individuals (farmers, etc.) in the province.

Dividing biotechnology activities or budgets by sector is quite often arbitrary in light of their interdisciplinary, cross-sectoral nature. Some responses reported animal health care expenditures within livestock agriculture while in others they were reported separately. There were similar problems in fields such as food or chemical production. In some cases these processes were classified by their resource materials (pulp wastes, etc.), in others by their end products and in still others by the nature of the process (i.e., waste treatment). Fermentation is an important technology for many biotechnology applications, and it was thus accorded a separate category. The projects included in this category were mostly in the field of process technology and engineering, but also included enzyme effectiveness and selection studies. While some agencies carefully categorized their activity, others did not. In the latter cases, the sectoral designation was made by the author.

**Table 3 and figure 2** (1985/86 Biotechnology Budgets - by sector) show the patterns of activity in the various provincial governments. Not surprisingly, much of the activity is related to the natural resource sectors which are also major contributors to GNP in Canada. The four major sectors, agriculture, health care, fermentation and forestry are closely related to the four major networks set up as part of the National Biotechnology Strategy. These four sectors comprise 93% of total provincial government spending in biotechnology.

A comparison of provincial spending patterns with those of the federal government and industry is complicated by differing reporting bases. The existing data is, however, sufficient to indicate major areas of spending at each level. The federal government spends the largest share of its biotechnology R&D funds on basic, enabling research to develop the science base. The next funding priority is agriculture. A significant proportion of overall federal spending on biotechnology is for grants to industry and universities. Industry spending focuses on three sectors: health care, agriculture, and food and beverage.

The provincial priorities of agriculture, health care, fermentation and forestry appear to be complementary to efforts at the other levels. The gap between the science base developed by the universities and the federal government and the developmental and commercialization research done by industry is in many cases filled by provincial efforts. Provincial biotechnology spending tends to indicate regional biases, with aquaculture receiving attention on the coasts and agriculture being predominant in the prairies. Overall, there appears to be a productive degree of complementarity between provincial governments' activity and activity by the federal government and industry.

**Figure 3** indicates the type of spending being done by provincial government agencies. The majority **(60.5%)** of the spending is either going for **industrial support** or to **industrial research organizations.** This confirms the provincial approach of encouraging industry and sponsoring research of particular provincial interest. Ontario and Québec are the major spenders in support of industry. Most other provinces spend relatively less on direct industrial grants or subsidies. Their spending in this regard is either in the form of contract research in support of industry, or small investments in biotechnology firms.

**In-house research** and research contracted to other government agencies accounts for **27.8%** of biotechnology spending. Much of the in-house spending is in the dominant fields of agriculture, forestry and fermentation. The contract research agencies (including many of the provincial research organizations) tend to be working in more specific fields in which they have developed expertise beyond that available elsewhere. They are working in fields such as mineral leaching, waste treatment and oil recovery.

The final **11.7%** of biotechnology spending is on **university support,** mostly in the form of grants. While **Alberta Agriculture** has committed $50,000 per annum for five years (1985-89) for a Research Chair in Agricultural Biotechnology at the University of Alberta, most of the rest of the spending on university support across the country is not specifically earmarked for biotechnology. Funds are made available to universities through various research grant

programmes or through unsolicited grants. Most of these funds that are spent on biotechnology are for projects in agriculture, health care and forestry.

## HUMAN RESOURCES

As noted earlier, provincial governments do not consider pure research to be central to their mandates. For this reason, there are relatively few human resources allocated to biotechnology in provincial agencies. A large part of the provincial activity and spending for biotechnology is in the form of grants, loans and subsidies.

Human resource allocations to biotechnology in all provincial agencies total less than one hundred person-years. The data collected in the survey was not adequate for use in detailed analysis of trends, etc., but several general comments can be made.

Of the agencies performing research, few reported more than four person-years committed to biotechnology. A notable exception was the Alberta Research Council, which reported 25 person-years in their biotechnology division. While the small number of researchers in each team is not a critical problem, it may inhibit the interdisciplinary approach that is needed in tackling biotechnology problems. Additionally, there is a danger that with small, isolated, research teams, communications may not be adequate to ensure that research stays at the cutting edge of the technology, and that there are no duplications of effort.

Another indication from the data was that there are very few engineers working on biotechnology projects. This trend has been noted in the United States as well, and has been identified as a factor that slows the pace of biotechnology commercialization. Encouragement of bioprocess engineering should perhaps be considered in the design of programmes to develop highly qualified manpower in Canada. In British Columbia, UBC is attempting to develop an industrial professorship in bioprocessing. Other provinces will undoubtedly develop similar programmes.

## RECRUITING, EDUCATION AND TRAINING PROGRAMMES AND INITIATIVES

Biotechnology has been accorded strategic importance in many provinces. As was mentioned earlier, however, the focus of activity in provincial agencies is towards industrial support, not pure research. Industrial support activities are not particularly human resource intensive, and they certainly do not require the highly trained scientific personnel needed for R&D. For this reason, there is relatively little recruiting activity going on in provincial agencies.

Some of the research-oriented departments and the provincial research organizations are doing limited recruiting. They are interested in training in basic sciences such as microbiology, molecular biology and analytical chemistry. The contract research organizations (PROs, etc.) are looking for applied research personnel in fields such as biochemistry, genetic engineering, separations, etc.

External training programmes do not appear to be widely used by provincial government agencies for training personnel in biotechnology. Very few agencies reported any use of external training. The research-oriented agencies reported that they relied on universities and on-the-job training for most of their needs. Several of the policy-oriented agencies reported sending personnel on general introductory courses that gave a background of possibilities and opportunities in the field.

Several provinces have developed educational programmes for biotechnology. The **Alberta Government's Advanced Education** department has recently approved a **programme in Agricultural biotechnology** at the University of Alberta. The **Ontario Government's Ministry of Skills Development** has developed a community college-based **technologists' programme** in the field. Several other provinces are involved in committees studying the possibility of implementing biotechnology programmes at universities. Researchers involved in biotechnology are skeptical about the merits of having a programme in biotechnology per se. They prefer extension courses offered at an advanced level on specific topics (genetic manipulation, tissue culture, etc.). This approach is being encouraged in Saskatchewan.

## PAST AND FUTURE TRENDS

Biotechnology, except in the health care and food and beverage industries, is a relatively recent undertaking in Canada. Most agencies reported biotechnology budgets starting around 1982. In the 81/82 fiscal year, approximately $1.3 million was spent on provincial biotechnology related projects. The major sectors were agriculture and forestry, together accounting for over $900,000. In the succeeding years, biotechnology spending has increased to $19.7 million. This fifteen-fold increase does not, however, represent an explosion in biotechnology budgets at the various research agencies. Most agencies reported only gradual growth in their budgets. A large part of the increase is from the initiation of new programmes at agencies across the country. Major programmes, such as the Québec government's biotechnology strategy allocations and the Ontario funding to Allelix, represent a significant part of the increase in recent years.

Many research centres did not provide spending estimates for the years prior to 1985, but did indicate that they were active in biotechnology; therefore, it was not possible to make concrete conclusions as to overall spending trends. Most agencies reported that there are no significant spending increases expected for 86/87. The contract research agencies are expecting to be able to increase their activity substantially because of the potential they see in biotechnology, but of course are uncertain of future budget levels.

Consistent with their restrained spending predictions, most of the agencies did not identify any expected new directions for their R&D activities. Of those that did specify future initiatives, projects in agriculture, forestry, aquaculture and fermentation technology were highlighted. Subjects such as protein engineering, which are at the forefront of activity elsewhere in the world, were rarely mentioned as future priorities for provincial agencies. The responsibility for frontier research and basic, long-term research is more appropriately given to industry, university and the federal government.

## CONCLUSIONS

A recurring theme in this report has been the need for better **communication and cooperation.** Communication between various researchers at the provincial level across the country is a key to ensuring that research proceeds at the state-of-the-art. Biotechnology is developing at a rate which makes conventional scientific publication too slow a medium to be used for communicating discoveries. Many of the respondents to this questionnaire expressed a keen desire to know more about what is going on in other parts of the country. A particular concern expressed at the Edmonton provincial workshop related to safety regulations in biotechnology. There was agreement that a consistent national approach was needed, and that better communications were essential to its development.

There are gaps in communications at the federal-provincial level as well. In many cases the provincial agencies have little idea of the work being done at federal research laboratories. By the same token, this survey represented the federal government's first effort to discover what specific activity is underway in the provinces. While the existing Biotechnology Networks appear to provide good information exchange within the various sectors, a more general form of communication between sectors is needed for issues that span several sectors.

**Cooperation** can be a controversial subject when different provincial governments and/or the federal government are involved. Questions related to project direction and management as well as funding are always subject to debate. However, at the very least,

**some form of communication between provincial agencies and the Interdepartmental Committee on Biotechnology should be considered.** Although this federal Committee is composed of line departments that have firm mandates and research plans, the dissemination of some of these plans to the provinces and a reciprocal indication of provincial strengths and priorities could result in the **planning of complementary efforts.**

At present, the main contact in biotechnology between the provinces and the federal government is through the **National Biotechnology Advisory Committee.** While the Committee has been quite active in summarizing the views of industry, universities and government and forwarding them to the Minister of State for Science and Technology, the provinces have expressed concern about the time lapse between recommendations and action. Additionally, they were interested in operational consultations with the federal government which are not really possible through an advisory committee.

**In conclusion, better communication is a key factor in improving government efforts in biotechnology.** This survey on provincial activities and similar studies on federal and industry activities are intended to facilitate this communication and should be updated and improved regularly and the information distributed widely. Federal-provincial contact should be at the operational level so that concrete dialogues can be established. Finally, existing federal-provincial agreements for funding biotechnology should be maintained.

## TABLE 1

## MAJOR GOVERNMENT BIOTECHNOLOGY R&D CENTRES AND INITIATIVES

### MARITIME REGION

| PROVINCIAL GOVERNMENT | | FEDERAL GOVERNMENT | |
|---|---|---|---|
| Agency | Activities | Agency | Activities |
| New Brunswick Research and Productivity Council | - Micropropagation (Forestry)<br>- Aquaculture | National Research Council Atlantic Research Laboratory | - Products from marine organisms<br>- Aquaculture and related studies |
| Nova Scotia Research Foundation Corporation | - Mycorrhizae (crops and forest)<br>- Microbial & enzymatic modification of lignin/cellulose | Agriculture Canada Research Stations<br>- Fredericton, N.B.<br>- Charlottetown, P.E.I.<br>- St. John's, Nfld. | - Potato breeding and development<br>- Dairy cattle breeding |
| Nova Scotia Agricultural College | - Plant culture studies<br>- Screening for stress tolerant plant varieties | | |
| P.E.I. Department of Agriculture | - Tissue testing and nutrition of potatoes<br>- Embryo techniques in swine | | |

TABLE 1 (cont'd)

MAJOR GOVERNMENT BIOTECHNOLOGY R&D CENTRES AND INITIATIVES

QUÉBEC REGION

PROVINCIAL GOVERNMENT

| Agency | Activities |
|---|---|
| Centre de récherche industrielle du Québec (CRIQ) | - Fermentation |
| Centre de valorisation de la biomasse du Québec | - Biomass conversion |

FEDERAL GOVERNMENT

| Agency | Activities |
|---|---|
| National Research Council Biotechnology Research Institute | - Biochemical engineering<br>- Enzyme engineering<br>- Molecular immunology<br>- Genetic engineering |
| Agriculture Canada Food Research Centre - St-Hyacinthe | - Agri-food |
| Research Stations - Lennoxville | - Animal research |
| - Ste-Foy | - Field crop & soil research |
| - St-Jean | - Fruit & vegetable strain development |

TABLE 1 (cont'd)

## MAJOR GOVERNMENT BIOTECHNOLOGY R&D CENTRES AND INITIATIVES

## ONTARIO REGION

### PROVINCIAL GOVERNMENT

| Agency | Activities |
|---|---|
| Ontario Research Foundation | - Waste processing<br>- Mineral leaching<br>- Mineral bioprocessing<br>- Fermentation |
| Ontario Tree Improvement and Forest Biomass Institute | - Tree strain improvement |
| Ontario Agriculture University of Guelph | - Nitrogen bioprocessing<br>- Plant strain development |

### FEDERAL GOVERNMENT

| Agency | Activities |
|---|---|
| Environment Canada<br>- Conservation and Protection Service | - Waste processing technology |
| Energy, Mines and Resources<br>- CANMET | - Bioleaching<br>- Biocorrosion<br>- Demethanation of coal |
| - Renewable Energy Division | - Butanol fermentation<br>- Lignocellulosics to specialty chemicals<br>- Wood products and degradation |
| Agriculture Canada<br>Chemistry and Biology Research Institute | - Nitrogen fixation |
| Animal Disease Research Institute<br>Animal Research Centre | - Animal health and protection |
| Central Experimental Farm<br>Research Stations<br>- London<br>- Harrow<br>- Delhi | - Improvement of productivity and crop production<br>- Nitrogen fixation<br>- Fungicides, herbicides, insecticides, agribacterium, rhizobium genetics<br>- Tobacco genetics, physiology and breeding |
| National Research Council<br>Division of Biological Science, Ottawa | - Biochemistry, biophysics, biomathematics<br>- Microbiology<br>- Molecular genetics<br>- Physiology |

**TABLE 1 (cont'd)**

**MAJOR GOVERNMENT BIOTECHNOLOGY R&D CENTRES AND INITIATIVES**

**PRAIRIE REGION**

**PROVINCIAL GOVERNMENT**

| Agency | Activities |
|---|---|
| Manitoba Research Council | |
| - Industrial Technology Centre | - Animal health, fermentation, industrial applications |
| - Canadian Food Products Centre | - Food processing technology |
| Saskatchewan Research Council | - Enzyme hydrolysis |
| | - Plant herbicides/ pesticides/growth regulants |
| | - Food production from agricultural wastes |
| Saskatchewan Agriculture* | - Plant genetic studies |
| | - Bioinsecticides |
| Alberta Research Council | - Fermentation/scale-up |
| | - Plant strain development |
| Alberta Environmental Centre | - Microbial toxicity services |
| | - Microbial waste processing |
| | - Cellulose biotechnology |

**FEDERAL GOVERNMENT**

| Agency | Activities |
|---|---|
| Agriculture Canada Research Stations | |
| - Winnipeg, Manitoba | - Cereal breeding |
| - Brandon, Manitoba | - Reproduction physiology of cattle and swine |
| | - Barley breeding |
| | - Nitrogen fixation |
| - Saskatoon, Saskatchewan | - Plant tissue culture (Alfalfa) |
| | - Improvement of oilseed crops |
| - Lethbridge, Alberta | - Microbiology and biochemistry of digestion |
| | - Role of rumen microorganisms |
| | - Nitrogen fixation |
| | - Breeding of beans |
| - Beaverlodge, Alberta | - Nitrogen fixation |
| | - Strain improvement of rhizobium |
| | - Rapeseed breeding |
| National Research Council | |
| - Plant Biotechnology Institute, Saskatoon, Saskatchewan | - Plant cell technology |
| | - Plant molecular genetics |
| | - Plant products technology |
| | - Plant & microbial productivity |

TABLE 1 (cont'd)

MAJOR GOVERNMENT BIOTECHNOLOGY R&D CENTRES AND INITIATIVES

PRAIRIE REGION
(Cont'd)

| PROVINCIAL GOVERNMENT | | FEDERAL GOVERNMENT | |
|---|---|---|---|
| Agency | Activities | Agency | Activities |
| Alberta Agriculture* | - Plant strain development<br>- Animal disease research | | |
| Alberta Forest Service | - Tigney Steam Explosion<br>- Wood pretreatment for fermentation | | |

* Primarily granting agencies for agricultural projects.

TABLE 1 (cont'd)

MAJOR GOVERNMENT BIOTECHNOLOGY R&D CENTRES AND INITIATIVES

BRITISH COLUMBIA

| PROVINCIAL GOVERNMENT | | FEDERAL GOVERNMENT | |
|---|---|---|---|
| Agency | Activities | Agency | Activities |
| B.C. Research | - Mineral leaching/ bioprocessing<br>- Hydrocarbon recovery<br>- Aquaculture<br>- Exotic mushrooms grown on mill wastes<br>- Biological waste treatment | Agriculture Canada Research Stations<br>- Agassiz<br>- Summerland<br>- Vancouver | - Trace mineral elements/ animal health<br>- Fruit tree tissue culture<br>- Plant viruses, virus vectors<br>- Molecular genetics |
| Terry Fox Medical Research Foundation<br>Subsidiaries:<br>- Pacific Isotopes and Pharmaceuticals Ltd.<br>- Biomedical Processing Centre (UBC)<br>- Biomedical Research Centre Ltd. (UBC) | - Human health care<br>- Cancer research | Fisheries and Oceans<br>- Pacific Biological Station | - Salmon breeding/ aquaculture |

Table 2

1985/86 Provincial Biotechnology Budgets

- By Province (and Source)

| Province | Total Budget $000 | Source of Funds | | |
|---|---|---|---|---|
| | | Federal* $000 | Provincial $000 | Industry $000 |
| Ontario | 6,780** | 370 | 6,375 | 35 |
| Quebec | 6,000 | -- | 6,000 | -- |
| Alberta | 2,955 | 360 | 2,145 | 450 |
| British Columbia | 2,077 | 120 | 1,657 | 300 |
| Saskatchewan | 672 | 32 | 638 | 2 |
| Manitoba | 563 | 99 | 389 | 75 |
| Newfoundland | 253 | 18 | 235 | -- |
| Nova Scotia | 210 | 105 | 105 | -- |
| P.E.I. | 127 | 63 | 64 | -- |
| New Brunswick | 70 | 30 | 20 | 20 |
| | 19,707 | 1,197 | 17,628 | 882 |
| | | (6.1%) | (89.4%) | (4.5%) |

* These amounts are federal contributions to provincial projects. They do not include federal funding of R&D in federal institutes or universities in the province. Also not included are federal contributions through ERDA sub-agreements. Provincial ERDA contributions are included in most provincial totals.

** This amount includes $5.7 M to Allelix, which although not a provincial project per se, represents a significant commitment to biotechnology by the Ontario government.

Table 3

1985/86 Provincial Biotechnology Budgets

- By Sector (and Source)

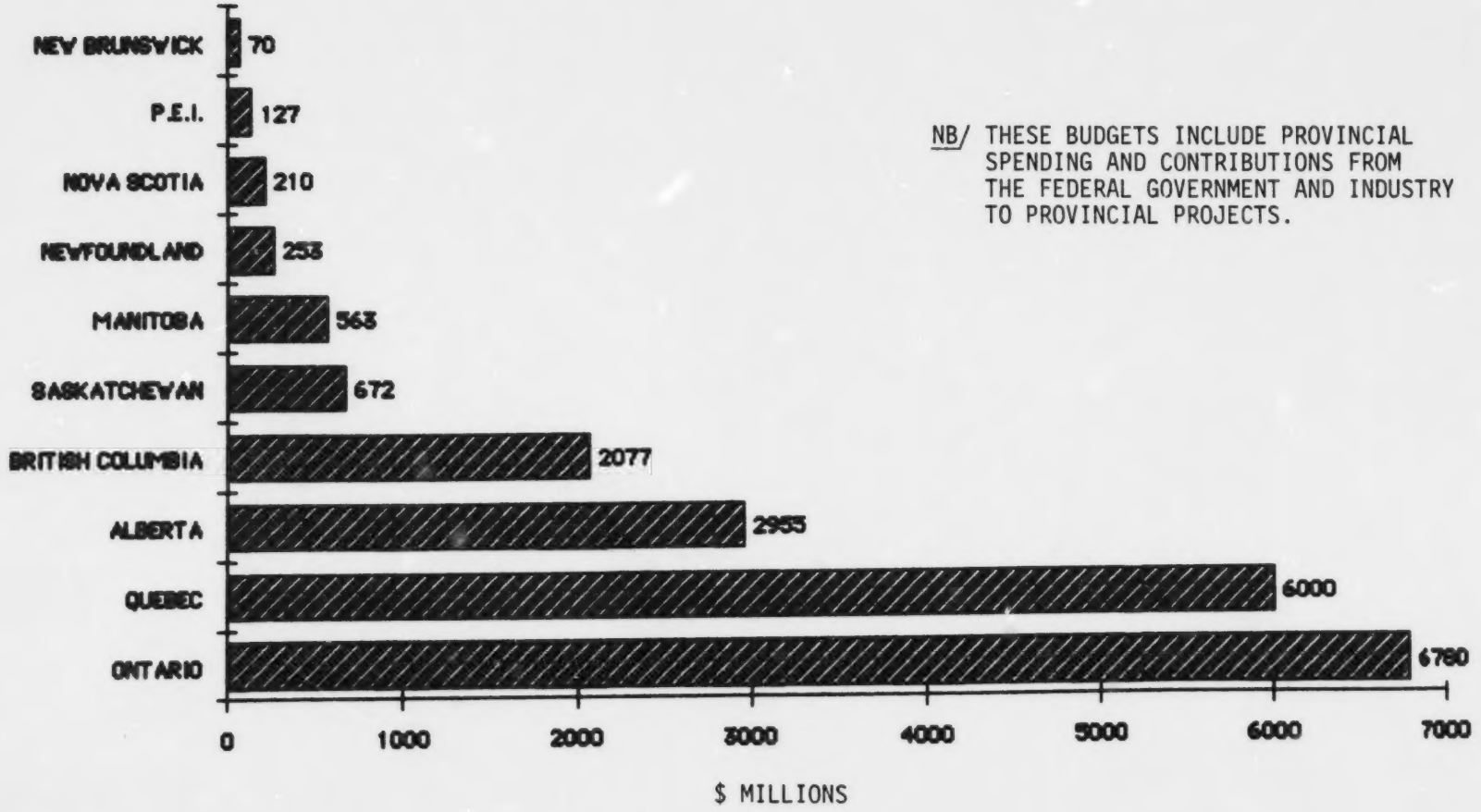
| Sector | Total Budget $000 | Source of Funds | | |
|---|---|---|---|---|
| | | Federal* $000 | Provincial $000 | Industry $000 |
| Agriculture | 7,638 | 185 | 7,436 | 17 |
| Health Care | 4,587 | 19 | 4,562 | 6 |
| Fermentation | 2,775 | 247 | 2,478 | 50 |
| Forestry | 2,420 | 275 | 1,933 | 212 |
| Chemicals | 594 | 140 | 241 | 213 |
| Mineral Processing | 564 | 135 | 177 | 252 |
| Waste Treatment | 408 | 87 | 291 | 30 |
| Aquaculture | 267 | 40 | 207 | 20 |
| Energy | 220 | 65 | 75 | 80 |
| Food and Beverage | 127 | 4 | 121 | 2 |
| Education | 66 | -- | 66 | -- |
| Other | 41 | -- | 41 | -- |
| | 19,707 | 1,197 | 17,628 | 882 |

* These amounts are federal contributions to provincial projects. They do not include federal funding of R&D in federal institutes or universities in the province. Also not included are federal contributions through ERDA sub-agreements. Provincial ERDA contributions are included in most provincial totals.

FIGURE 1

1985/86 PROVINCIAL BIOTECHNOLOGY BUDGETS

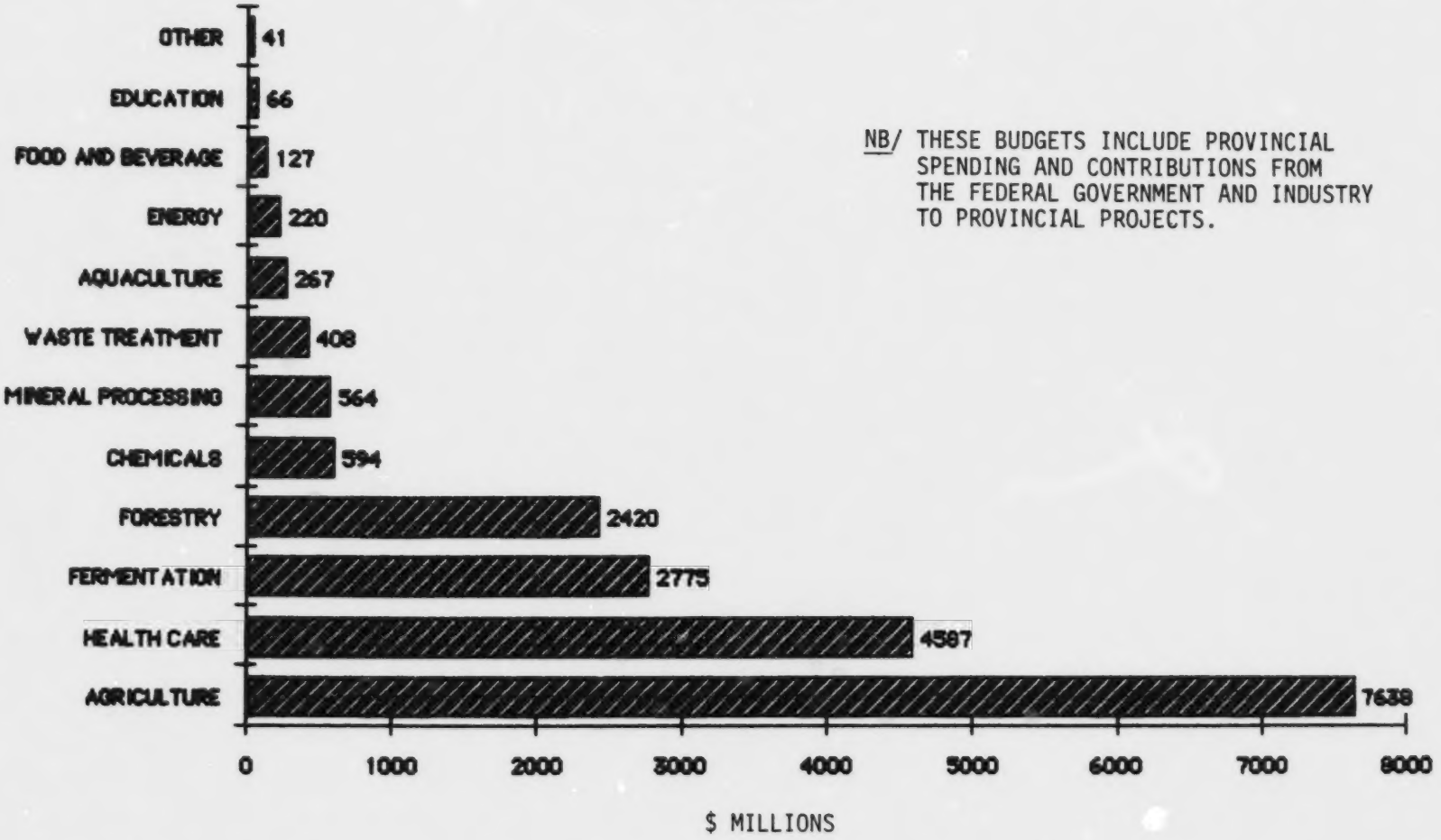
BY PROVINCE




NB/ THESE BUDGETS INCLUDE PROVINCIAL SPENDING AND CONTRIBUTIONS FROM THE FEDERAL GOVERNMENT AND INDUSTRY TO PROVINCIAL PROJECTS.

FIGURE 2

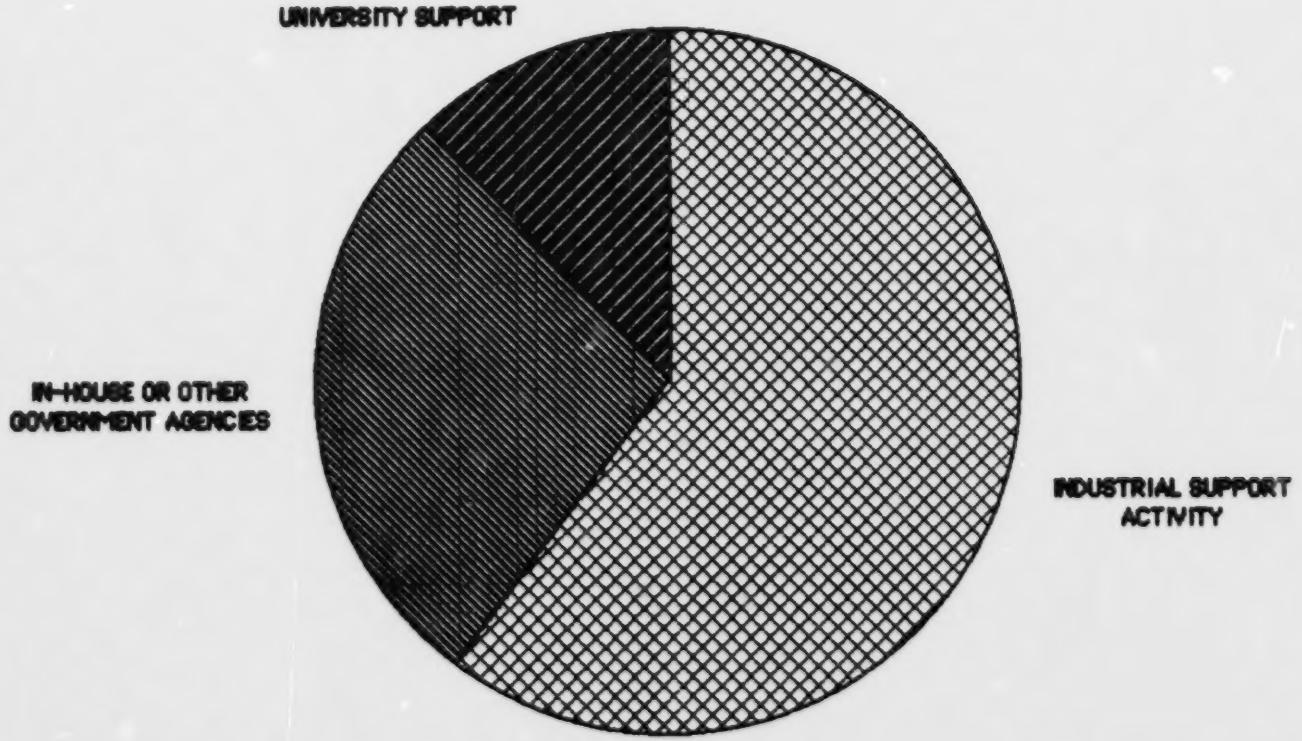
1985/86 PROVINCIAL BIOTECHNOLOGY BUDGETS
BY SECTOR




NB/ THESE BUDGETS INCLUDE PROVINCIAL SPENDING AND CONTRIBUTIONS FROM THE FEDERAL GOVERNMENT AND INDUSTRY TO PROVINCIAL PROJECTS.

FIGURE 3

PROPORTION OF PROVINCIAL BIOTECHNOLOGY PROGRAMME SPENDING
TO VARIOUS LEVELS




TOTAL ADMINISTERED BY PROVINCIAL GOVERNMENT AGENCIES - $19.7 MILLION

NB THIS SPENDING INCLUDES PROVINCIAL EXPENDITURES AND CONTRIBUTIONS FROM THE FEDERAL GOVERNMENT AND INDUSTRY TO PROVINCIAL PROJECTS.

## APPENDIX A

## FUNCTIONS OF AGENCIES INVOLVED WITH BIOTECHNOLOGY

### Research Oriented Agencies

Newfoundland and Labrador Department of Forest Research and Lands
Newfoundland and Labrador Department of Rural Agriculture and Northern Development
Newfoundland and Labrador Department of Fisheries
P.E.I. Department of Agriculture
Nova Scotia Research Foundation Corporation
Nova Scotia Agricultural College
New Brunswick Research and Productivity Council
Centre de Récherche industrielle du Québec
Centre québécois de valorisation de la biomasse
Ontario Ministry of Natural Resources
Ontario Research Foundation
Manitoba Research Council
Manitoba Department of Energy and Mines
Saskatchewan Research Council
Alberta Environmental Centre
Alberta Forest Service
B.C. Research
Terry Fox Medical Research Foundation

### Agencies with Available Funding for Biotechnology Research and/or Ventures

P.E.I. Energy Corporation
Nova Scotia Department of Development
New Brunswick Energy Secretariat
BIO AGRAL
AQVIR
Ontario Ministry of Health
IDEA Corportation
Ontario Development Corporation
Manitoba Health Industry Development Initiative
Manitoba Health Research Council
Saskatchewan Department of Agriculture
Science Council of British Columbia
Discovery Foundation/Discovery Enterprises Inc.
B.C. Health Care Research Foundation

### Policy Agencies*

Newfoundland and Labrador Department of Development and Tourism
P.E.I. Development Agency
Nova Scotia Department of Health

Policy Agencies* (cont'd)

New Brunswick Department of Commerce and Technology
Ministère de l'Enseignement supérieur de la Science et de la Technologie, Québec
Ontario Ministry of Industry, Trade and Technology
Ontario Ministry of Skills Development
Manitoba Department of Industry, Trade and Technology
Saskatchewan Department of Science and Technology
British Columbia Ministry of International Trade, Science and Investment
British Columbia Ministry of Forests
British Columbia Ministry of Agriculture and Food
British Columbia Ministry of Health

* Many of these agencies are also funding agencies, but their major function at this time appears to be in promoting biotechnology development and guiding appropriate policy implementation.

# APPENDIX B

## SOURCE BOOK OF PROVINCIAL ORGANIZATIONS

## INVOLVED IN BIOTECHNOLOGY

The following summaries were prepared for each agency that submitted a response to the questionnaire "MOSST INVENTORY OF BIOTECHNOLOGY ACTIVITY IN PROVINCIAL ORGANIZATIONS."

## SOURCEBOOK INDEX


| Province | Entry Number |
|---|---|
| British Columbia | 1, 2, 3, 4 |
| Alberta | 5, 6, 7, 8 |
| Saskatchewan | 9, 10, 11 |
| Manitoba | 12, 13, 14, 15, 16, 17 |
| Ontario | 18, 19, 20, 21, 22, 23, 24 |
| Québec | 25 |
| New Brunswick | 26, 27, 28 |
| Nova Scotia | 29, 30, 31 |
| Prince Edward Island | 32, 33, 34 |
| Newfoundland | 35, 36, 37, 38 |

| Type of Activity | Entry Number |
|---|---|
| R&D | 2, 4, 5, 6, 8, 10, 13, 14, 17, 19, 22, 27, 29, 31, 33, 35, 36, 37, 38 |
| Policy | 1, 9, 12, 18, 20, 21, 23, 25, 26, 30, 32 |
| Funding | 9, 12, 16, 18, 20, 24, 25, 26, 30, 32, 34 |
| Granting | 3, 7, 11, 15, 21, 28, 34 |

| Sector | Entry Number |
|---|---|
| Agriculture | 5, 7, 10, 11, 14, 25, 29, 31, 33 |
| Forestry | 2, 3, 4, 8, 22, 25, 27, 29, 35 |
| Fermentation | 5, 10, 14, 18, 25, 29 |
| Health Care | 14, 15, 16, 21, 24, 25 |
| Waste Processing | 2, 6, 10, 18, 37, 38 |
| Energy | 2, 17, 28, 34 |
| Aquaculture | 26, 36 |
| Mineral Processing | 2, 14, 18 |
| Food Processing | 13, 25 |
| Education | 7, 23 |

## Introduction

This Sourcebook has been compiled in conjunction with the MOSST Inventory of Biotechnology Activity in Provincial Government Organizations. The entries summarize data obtained through questionnaires and through personal and telephone consultations with representatives of the various agencies.

It is intended that this sourcebook be used as an information source for potential contacts and general areas of interest or expertise. The listings are not exhaustive, giving only the basic facts plus general information on the projects underway. The budget and human resource figures are estimates made by each agency of their allocations to specific biotechnology-related projects. The budget figures, in most cases, do not include salaries or capital equipment.

Efforts were made by telephone and letters as well as through contacts in each province to identify all the provincial agencies involved in biotechnology. It is possible, however, that agencies have been missed. There have been isolated cases of refusal to answer the questionnaire, and in other cases information has been delayed by the provincial agencies.

The sourcebook includes an entry for each agency as well as a short summary of the activities in each province.

## BRITISH COLUMBIA

The Provincial Government's primary focus in supporting and funding biotechnology R&D and commercial ventures is in three areas; human and animal related health care products/biologicals; forest related biotechnology (including plant strain development and disease control); and, most recently, aquaculture biotechnology (fish feed/ vaccines/diagnostic kits). Further activities have been undertaken in the field of cellulose and waste management/bioconversion and in mineral leaching/metal recovery. These areas correspond to the four areas identified as biotechnology networks under the National Biotechnology Strategy. The Ministry of International Trade, Science and Investment maintains a provincial responsibility for promoting and facilitating biotechnology activity in concert with other ministries and government agencies, industry and the research community.

The Ministry is currently promoting two major initiatives in biotechnology. The establishment of a Biomedical Processing Centre and a Biomedical Research Centre at the University of British Columbia is a major project with combined government/industry funding in excess of $40 million over 5 years. This initiative falls under the auspices of the Terry Fox Medical Research Foundation. Its major focus of effort will be interferon and other anti-cancer and health care/biological products. The Ministry is also active in promoting a major initiative in forest biotechnology. It is promoting the linkage of universities, industry and government in a major research effort to improve the quality, yield and efficiency of the B.C. forestry industry.

The **Science Council of B.C.** provided grants for several biotechnology projects in 85/86, in a range of fields from tissue culture and micropropagation to monoclonal antibodies.

The **Ministry of Forests** is presently limiting their activity to "moral encouragement" to researchers in biotechnology. One of their staff members is an adjunct professor at Simon Fraser University, and is supervising graduate students in the tissue culture program.

**B.C. Research** is active in product development, process applications, technology development and training in several fields of biotechnology. Several of their projects involve oil recovery, either through conversion to methane or by changing the viscosity by the formation of biopolymers. Another project uses pulp mill wastes for the production of exotic mushrooms. There is a major thrust in the field of aquaculture, both for the production of fish feed additives and for diagnostic tests. In addition, they are very active in the field of microbial metal extraction. Finally, there is a small project to produce test kits for detecting hydrocarbon degrading organisms and a second one to investigate the fermentability of wood waste products.

Entry Number: 1

**NAME:** B.C. MINISTRY OF INTERNATIONAL TRADE, SCIENCE AND INVESTMENT
SCIENCE AND TECHNOLOGY DIVISION

| | |
|---|---|
| **ADDRESS:** 818 Fort St.<br>3rd Floor<br>Victoria, British Columbia<br>V8V 1X4 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** N/A |
| **TELEPHONE #:** (604) 387-2033<br>**TELEX #:**<br>**CONTACT PERSON:** Barry Stevenson<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>Government Branch responsible for programme development and funding and for the coordination of science and R&D activities. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

This Division assists in coordinating and promoting R&D activity including biotechnology. This Ministry provides discretionary funding to support the R&D activities and investment in research and commercial venture risk financing of advanced technology. Specific funding is made available to B.C. Research, the Science Council of B.C., and Discovery Foundation/ Discovery Enterprises Inc. It is active in the promotion of biotechnology in the province.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** *

$1 million (ERDA S&T sub-agreement) plus funds allocated to provincial agencies as noted above.

**TOTAL PERSON-YEARS 85/86:** *

*There are no specific biotechnology allocations, except the ERDA sub-agreement.

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| ERDA Science & Technology Sub-agreement (Program #1)<br>- Biomedical Processing Centre, UBC. | (as above) |
| Forest Biotechnology Centre (Proposal)<br>- University of British Columbia<br>- Simon Fraser University<br>- Various industry concerns<br>- Federal and provincial governments. | (as above) |

**COMMENTS:**

Entry Number: 2

**NAME:** B.C. RESEARCH

**ADDRESS:** 3650 Wesbrook Mall
Vancouver, British Columbia
V6S 2L2

**TELEPHONE #:** (604) 224-4331
**TELEX #:** 04-507748
**CONTACT PERSON:** Dr. R.W. Lawrence/
Dr. Josef C. Mueller
**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**
The technical operation of the British Columbia Research Council. A non-profit society providing contract R&D to industry and government.

**RESEARCH FACILITIES**

**ADDRESS:** Same

**TELEPHONE #:**
**CONTACT PERSON:**
**DESCRIPTION:**

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Product development, process applications, technology development, training.
Projects related to natural resource extraction and processing;
eg. - metal extraction - hydrocarbon extraction and processing
- wood utilization - environmental management.
Specific topics sponsored by industry - food fermentation, biological waste treatment (pulp mill effluents, domestic sewage).

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $700,000

**TOTAL PERSON-YEARS 85/86:** 8.0

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Methanation of hydrocarbons. | Mr. E.G.-H. Lee |
| Polymers from methanol. | Dr. J.C. Mueller/E.G.-H. Lee |
| Carotenoids from yeast. | Dr. J.C. Mueller |
| Diagnostic Tests (Aquaculture). | Mr. R. Gawley/E.G.-H. Lee |
| Exotic Mushrooms. | Mr. R. Gawley/J.C. Mueller |
| Bio-metallurgy. | Dr. R.W. Lawrence |
| Biological Waste Treatment. | Mr. A. Birkbeck/J.C. Mueller (all at above address and telephone number) |

**COMMENTS:**

Entry Number: 3

**NAME:** SCIENCE COUNCIL OF BRITISH COLUMBIA

| | |
|---|---|
| **ADDRESS:** 100-3700 Gilmore Way<br>Burnaby, British Columbia<br>V5G 4M1 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** N/A |
| **TELEPHONE #:** (604) 438-2752<br>**TELEX #:**<br>**CONTACT PERSON:** Dr. Max Cairns<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:** Government funded agency acting at arms' length as a science and research advisor to the provincial government. Is also a support agency for applied research (grants, scholarships, fellowships). | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Technology development, process applications, product development, industrial stimulation.

Activity depends on grant applications.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $378,000

**TOTAL PERSON-YEARS 85/86:**

Person-years are allocated by the individual research agencies (average 1-2 per project).

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Tissue culture and micropropagation of mature B.C. conifers. | Dr. Ian E.P. Taylor (UBC, Botany) |
| Propagation of conifer plantlets using tissue culture techniques. | Mr. Douglas E. Rickson (Canadian Forest Products, Vancouver) |

(continued)

**COMMENTS:** The above programmes are from the 85/86 grants list.

Entry Number: 3

**NAME:** SCIENCE COUNCIL OF BRITISH COLUMBIA

**SPECIFIC PROGRAMMES**
(continued)

**1985/85 Science Council of B.C. Funding of Biotech Related Projects**

| DESCRIPTION | CONTACT |
|---|---|
| Treatment of sewage lagoon effluent. | Dr. Ross Bulley (UBC, Bioresources Engineering) |
| Machine to test heart valve replacement/biotech application. | Mr. Lawrence Scotten and Dr. D.K. Walker (Vivitro Systems) |
| Diagnostic kit based on monoclonal antibodies. | Dr. Van Alstyne (Quadra Logic Technologies Inc.) |
| Fish waste bioprocessing (Fermentation for feed production). | Mr. Tom Higgs (Bion Research Limited) |
| Biological evaluation of tree stocks. | Dr. Wm. Vidaver (SFU, Department of Biological Sciences) |
| Plasma protein fractionation/ feed and pharmaceutical applications. | Dr. John Sim (UBC, Animal Science) |
| Monoclonal antibodies. | Dr. Daniel Liu (IPDF) (Quadra Logic Technologies Inc.) |
| Various biotech activities (G.R.E.A.T. Awards). | Ms. Kurz/Mr. Soulodry/ Mr. Decamillis (various industries) |

**COMMENTS:** The above programmes are from the 85/86 grants list.

Entry Number: 4

**NAME:** B.C. MINISTRY OF FORESTS, RESEARCH BRANCH

| | |
|---|---|
| **ADDRESS:** 1450 Government Street<br>Victoria, British Columbia<br>V8W 3E7 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** Several regional stations |
| **TELEPHONE #:** (604) 387-3226<br>**TELEX #:** 049-7263<br>**CONTACT PERSON:** Dr. Lorne F. Ebell<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:** Government Branch responsible for supplying the Ministry and other government agencies with information and advice on the latest techniques for improving forest and range management. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** Contact head office |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Educational initiatives, including academic and supervisory support for students in the field.

Awaiting perfection of tissue culture and micropropagation techniques. Anticipate setting up a production tissue culture lab.

Most activity is now in the form of "moral encouragement".

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** 0

**TOTAL PERSON-YEARS 85/86:** 0

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Provision of plant materials to university students. | |
| Dr. W. Binder of this Branch is an adjunct professor at Simon Fraser University in the field of tissue culture. | |

**COMMENTS:** Anticipate a $100K budget in the future for production tissue culture lab. Would support a provincial industry, government, universities cooperative in forest biotechnology.

## ALBERTA

**The Alberta Research Council** is active in technology development, process applications, product development and basic research in the fields of scale-up for industrial fermentation, plant strain development and genetic engineering. Their objective is to provide technical assistance and encouragement for the development of biotechnology industries in Alberta. Their computer controlled fermentation pilot plant is one of the most advanced in the world.

**The Alberta Environmental Centre's** biotechnology activity includes technology development, process applications, product development, industrial development/stimulation, regulation and/or related R&D, and basic research. Their activity is primarily in the field of microbial processing and testing of toxicants.

**Alberta Agriculture,** through their Farming for the Future Program, is supporting many projects involving biotechnology. They are, in cooperation with Canadian Pacific Company Limited, providing funding for a research chair in plant biotechnology at the University of Alberta. They also helped sponsor a Candadian Pacific/University of Alberta seminar on plant biotechnology in September 1985 and have recently participated in the formation of the Alberta Agriculture Research Institute at the University. In addition, they provide grants to researchers to carry out a wide range of agricultural biotechnology projects. They support work on cattle vaccines at the Veterinary Infectious Disease Organization (VIDO) in Saskatoon.

**The Alberta Forest Service** is involved in developing support technology for forest product biotechnology. Their biotechnology activity includes technology development, process applications, and industrial development/stimulation. They are involved in developing the Tigney Steam Explosion process for the treatment of wood prior to fermentation. They are also involved in investigating the possible products from lignin and cellulose degradation.

Entry Number: 5

**NAME:** ALBERTA RESEARCH COUNCIL

| | |
|---|---|
| **ADDRESS:** Box 8330, Station F<br>Edmonton, Alberta<br>T6H 5X2 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** 2501 Karl Clarke Rd.<br>Edmonton, Alberta<br>T6N 1E4 |
| **TELEPHONE #:** (403) 450-5205<br>**TELEX #:** 037-2147<br>**CONTACT PERSON:** Dr. Duncan Currie<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:** Provincial Crown Corporation promoting responsible economic development in Alberta through a broad range of research in science and technology. | **TELEPHONE #:** (403) 450-5111<br>**TELEX #:**<br>**CONTACT PERSON:** Dr. Don Gerson<br>**DESCRIPTION:** Range of fermenters up to 2600 Litres. VAX 11/730 computer for process control and development. |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Technology development, process applications, product development, industrial stimulation, educational territories.

Promotes the development of a biotechnology industry in Alberta;
- Fermentation and scale-up
- Cell culture/crop improvement
- Production/synthesis of proteins, genes, growth hormones, etc.
- Genetic engineering.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $1,500,000

**TOTAL PERSON-YEARS 85/86:** 25.0

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| 1. Industrial microbiology and strain improvement. | |
| 2. Fermentation and scaling up for the production of biomass. | Dr. D. Currie and/or Dr. D. Gerson |
| 3. Computer control fermentation. | |
| 4. Large scale production of proteins and their purification. | |
| 5. Genetic engineering research for the development of pharmaceuticals and specialty chemicals. | |
| 6. Use of plant cell culture to develop cold hardiness in plants. | |
| 7. Cereal tissue culture for shortening the time period for growth modification. | |
| 8. Alfalfa cell culture technology for *in vitro* selection. | |
| 9. Chemical synthesis of genes. | |
| 10. Chemical synthesis of growth hormones for plants. | |

Entry Number: 6

**NAME:** ALBERTA ENVIRONMENTAL CENTRE

| | |
|---|---|
| **ADDRESS:** Bag 4000<br>Vegreville, Alberta<br>T0B 4L0 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** Same |
| **TELEPHONE #:** (403) 632-6761<br>**TELEX #:** 037-42783<br>**CONTACT PERSON:** Dr. R.S. Weaver<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:** Government funded agency whose mandate calls for work in the areas of analytical and diagnostic services, applied research and technical development. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Technology development, process applications, product development, industrial stimulation, regulation R&D, basic research.

Microbial toxicity services.

Microbial metabolism of toxicants.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** Not available.

**TOTAL PERSON-YEARS 85/86:** Not available.

It was not possible to segregate the budgets and person years from the overall budgets of several departments.

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Programme/Project list is extensive. | (See above) |

**COMMENTS:**

Entry Number: 7

NAME: ALBERTA AGRICULTURE, RESEARCH DIVISION

| | |
|---|---|
| **ADDRESS:** Rm 206, J.G. O'Donoghue Bldg.<br>7000 - 113 Street<br>Edmonton, Alberta<br>T6H 5T6 | **RESEARCH FACILITIES**<br>**ADDRESS:** Same |
| **TELEPHONE #:** (403) 422-1382<br>**TELEX #:**<br>**CONTACT PERSON:** Dr. James Mahone<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:** Government Branch which administers provincial agricultural research grant programmes, co-ordinates agricultural research activities and assists with the dissemination of research information. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Basic research, technology development, product development.
- Research in biotechnology qualifies for financial assistance on the same basis as other agricultural disciplines.
- Financial support for a research chair in plant biotechnology at the University of Alberta.
- Improved crop varieties.
- Vaccine development for specified cattle diseases.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $485,000 *

**TOTAL PERSON-YEARS 85/86:** N/A

*Includes $50,000 to plant biotechnology research chair at the University of Alberta (jointly with Canadian Pacific Company).

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Various grants | (see above) |

**COMMENTS:** Funds granted through the Farming for the Future Program.

Entry Number: 8

**NAME:** ALBERTA FOREST SERVICE

**ADDRESS:** 10th Floor
Petroleum Plaza, South Tower
9915-108 Street
Edmonton, Alberta
T5K 2C9

**TELEPHONE #:** (403) 427-7418
**TELEX #:** 037-6376
**CONTACT PERSON:** B.W. Karaim
**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**
Government branch responsible for managing and controlling the development of wood resources in Alberta.

**RESEARCH FACILITIES**

**ADDRESS:** Alberta Research Council
Clover Bar Site
1021 Hayter Road
Edmonton, Alberta
T5J 2W7
**TELEPHONE #:** (403) 464-2960
**TELEX #:**
**CONTACT PERSON:** E.A. DeLong
**DESCRIPTION:**
Tigney Technology Pilot Plant

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Technology development, process applications, industrial development/ stimulation.

Funding the development of the Tigney Steam Explosion process for wood treatment before fermentation.

Investigating lignin and cellulose applications.

Building demonstration plants.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $970,000*

**TOTAL PERSON-YEARS 85/86:** 8.25*

*These amounts include $130,000 and 1.25 P/Y that may also have been reported by the Alberta Research Council as contract revenue. This project is a support technology to fermentation processes as opposed to direct biotechnology.

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| (See Above) | |

**COMMENTS:**

## SASKATCHEWAN

The Saskatchewan department of **Science and Technology** is responsible for the coordination of science and technology activities in all the provincial ministries and is at the forefront in promoting biotechnology as an important tool in the development of Saskatchewan's future. The department supports a series of programmes aimed at such things as industrial research, joint high technology research, and feasibility studies to stimulate industrial development. Biotechnology has been identified as a strategic technology in these programmes. With these programmes (part of the Advanced Technology Agreement with the federal government) as a basis, the department has been very successful in attracting biotechnology industries to the province.

The **Saskatchewan Research Council** is involved in technology development, process application, product development and basic research in support of industry and government. Their particular strengths are enzymes and enzyme systems, natural plant chemicals and production of products from agricultural and forestry waste products.

The Saskatchewan department of **Agriculture** is funding university research in biotechnology as well as developing policies to guide the use of biotechnology in the province. They are monitoring progress in the field, evaluating the possible uses of new developments and encouraging the use of new processes. Their funding is in the areas of plant genetics and bioinsecticides.

Entry Number: 9

**NAME:** SASKATCHEWAN SCIENCE AND TECHNOLOGY

| | |
|---|---|
| **ADDRESS:** Mall 3, Innovation Place<br>108 Research Drive<br>Saskatoon, Saskatchewan<br>S7N 2X8 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** N/A |
| **TELEPHONE #:** (306) 933-7200<br>**TELEX #:** 074-2484<br>**CONTACT PERSON:** Dr. A.J.Y. Guy<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>Government Department which promotes high technology research and industrial development. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Industrial stimulation, educational initiatives, policy development.

Several support programmes aimed at industry have direct relevance to biotechnology.

A federal/provincial working group under the Memorandum of Understanding on Advanced Technology is developing approaches to encourage and promote growth and development in agriculture biotechnology and to establish an Agricultural Biotechnology Institute in Saskatchewan.

An Interdepartmental Committee has been set up to address issues of biotechnology safety and regulations.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** N/A

**TOTAL PERSON-YEARS 85/86:** N/A

**SPECIFIC PROGRAMMES**

| **DESCRIPTION** | **CONTACT** |
|---|---|
| There are no specific programmes. However, existing programmes under the Canada/Saskatchewan Advanced Technology Sub-Agreement and under the Department of Science and Technology R&D Fund, can be, and have been, accessed for Biotechnology projects. | |

**COMMENTS:** Biotechnology has been designated of strategic importance. A federal-provincial ERDA sub-agreement specifically highlights biotechnology. This agreement has been used as a base for stimulating significant industrial activity in biotechnology in the province.

Entry Number: 10

**NAME:** SASKATCHEWAN RESEARCH COUNCIL

| | |
|---|---|
| **ADDRESS:** 30 Campus Drive<br>Saskatoon, Saskatchewan<br>S7N 0X1 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** Same |
| **TELEPHONE #:** (306) 664-5410<br>**TELEX #:** SARECO 074-2484<br>**CONTACT PERSON:** Dr. Ewen Coxworth<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>Provincial Research Organization supporting applied research and process, technology and product development. R&D resource for private sector. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Technology development, process applications, product development, industrial stimulation, basic research.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $281,527 + contracts to be signed.

**TOTAL PERSON-YEARS 85/86:** 8.0

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Biomass processing, plant products, growth regulants and herbicides. | Dr. Ewen Coxworth<br>SRC (306) 664-5410<br><br>Dr. Wayne Craig<br>SRC (306) 664-5415 |
| Utilization of enzymes in Canola processing.<br>New sources of enzymes, enzyme hydrolysis. | Dr. Krystyne Sosulski<br>SRC (306) 664-8136 |
| Feed processing. | Mr. Jack Kerman<br>SRC (306) 664-5446 |

**COMMENTS:** 48% of revenues (and above budget) is from contracts with NRC, DSS and private sector.

Entry Number: 11

**NAME:** SASKATCHEWAN AGRICULTURE, SOILS AND CROPS BRANCH

**ADDRESS:** Room 133, Walter Scott Building
3085 Albert Street
Regina, Saskatchewan
S4S 0B1

**TELEPHONE #:** (306) 787-4661
**TELEX #:** 071-2474
**CONTACT PERSON:** John Buchan
**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**
Government Branch committed to improving the competitiveness of Saskatchewan farms and the productivity of the agricultural industry.

Technology transfer, conservation.

**RESEARCH FACILITIES**

**ADDRESS:** N/A

**TELEPHONE #:**
**TELEX #:**
**CONTACT PERSON:**
**DESCRIPTION:**

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Process applications, industrial stimulation, policy development.

Advises on suitability of funding various biotechnology research projects. Monitors the progress of such projects, provides full scale evaluation of the possible uses of such developments, and promotes the use of viable finished products.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $390,646

**TOTAL PERSON-YEARS 85/86:** 0.01

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Genetic studies. | Dr. McHughen<br>Crop Development Centre<br>University of Saskatchewan |
| Bioinsecticides. | Dr. Khachatourians<br>Dairy and Food Science<br>Department<br>University of Saskatchewan |

**COMMENTS:** Presently all work is being contracted out, as indicated above. Expected contracts in the future include soil microorganisms, new crop strains and crop and livestock protection products.

## MANITOBA

In Manitoba, the department of **Industry, Trade and Technology** is actively promoting the development of a biotechnology industry in the province. Support for applied research and commercial activities in biotechnology is available under the Strategic Research and Technology Commercialization Programs, and for academic research under the Graduate Scholarships Program.

The **Manitoba Research Council**, through its **Industrial Technology Centre** and the **Canadian Food Products Development Centre**, is assisting industry with the commercial application of biotechnology processes. Their involvement includes livestock biotechnology, health care, and food and beverage processing.

The provincial government's **Health Industry Development Initiative** was established to encourage the development of companies that have an objective of applied research and development in health care related biotechnology.

**Manitoba Energy and Mines** is currently working on industrial processes for the manufacture of fuel alcohols from biomass. They are involved in technology development that will subsequently be tranferred to industry.

**The Manitoba Health Research Council** is a provincially funded granting agency giving operating grants and personnel awards for research in the health sciences. Although they have no specific focus on biotechnology, some of the grants are for research related to biotechnology.

Entry Number: 12

**NAME:** MANITOBA INDUSTRY, TRADE & TECHNOLOGY, TECHNOLOGY DIVISION

| | |
|---|---|
| **ADDRESS:** 214-155 Carlton Street<br>Winnipeg, Manitoba<br>R3C 3H8 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** N/A |
| **TELEPHONE #:** (204) 945-0127<br>**TELEX #:**<br>**CONTACT PERSON:** Dr. Ronald D. Humble<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:** Government Department responsible for policy and planning advice on science and technology. Delivery of related programmes. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Policy development, industrial stimulation.

Biotechnology has been designated a strategic technology under the Province's technology strategy. Promotion of biotechnology is being done in conjunction with a range of other advanced technologies.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** 0

**TOTAL PERSON-YEARS 85/86:** 0

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|

**COMMENTS:** Under the Province's Strategic Research and Technology Commercialization Programs, applied research and commercial activities in biotechnology are eligible for support, as is academic activity under the Graduate Scholarships Program.

Entry Number: 13

**NAME:** MANITOBA RESEARCH COUNCIL, CANADIAN FOOD PRODUCTS DEVELOPMENT CENTRE

| | |
|---|---|
| **ADDRESS:** P.O. Box 1240<br>Portage la Prairie, Manitoba<br>R1N 3J9 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** SAME |
| **TELEPHONE #:** (204) 857-7861<br>**TELEX #:**<br>**CONTACT PERSON:** Dr. T.J. McEwen<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>Provincial Research Organization providing technical assistance to industry through fee-for-service consulting for the purpose of economic and business development. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Process applications, product development, industrial development/ stimulation.

Has a mandate to assist industry in the commercial application of biotechnology processes.
- Applications of separation techniques to aid in recovery of macromolecules normally lost to traditional processing systems.
- Use of recovered macromolecules in the development of new products and as ingredients in existing products.
- Working towards the implementation of new technologies in the existing food and beverage industry.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $40,000

**TOTAL PERSON-YEARS 85/86:** 1.5

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Membrane Separation Studies. | Dr. T.J. McEwen |
| Food Waste Recovery Studies. | |

**COMMENTS:** They are expecting their level of activity to increase dramatically over the next few years ($130,000+ in 86/87 and up to $250,000 eventually). This increase will be in the field of separation science. Funding will be through the Province's Strategic Research Support Program.

Entry Number: 14

**NAME:** MANITOBA RESEARCH COUNCIL, INDUSTRIAL TECHNOLOGY CENTRE

**ADDRESS:** 1329 Niakwa Road E.
Winnipeg, Manitoba
R2J 3T4

**TELEPHONE #:** (204) 945-6137
**TELEX #:** 0758 5733
**CONTACT PERSON:** B.G. Dodds
**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**
Provincial Research Organization providing technology transfer, consulting and research to government and industry under a fee-for-service arrangement.

**RESEARCH FACILITIES**

**ADDRESS:** Same

**TELEPHONE #:**
**TELEX #:**
**CONTACT PERSON:**
**DESCRIPTION:**

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Technology development, process applications and product development in support of industry.
Major areas of interest include livestock agriculture, animal health care, plant strain development and fermentation and downstream processing.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $200,000

**TOTAL PERSON-YEARS 85/86:** 2.4

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Animal Health/Reproduction. | Dr. J.L. Agar<br>Embroserv Ltd.<br>4323 Roblin Blvd.<br>Winnipeg, Manitoba<br>R3R 0E8 |
| Remainder of time is applied to new project identification and the associated R&D. | B.G. Dodds |

**COMMENTS:**

Entry Number: 15

**NAME:** MANITOBA HEALTH RESEARCH COUNCIL

| | |
|---|---|
| **ADDRESS:** 750 Bannatyne Avenue<br>Winnipeg, Manitoba<br>R3E OW3 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** N/A |
| **TELEPHONE #:** (204) 775-1096<br>**TELEX #:**<br>**CONTACT PERSON:** Dr. Frits C. Stevens<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>Provincially funded granting agency for research in the health sciences. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Basic research.

Biotechnology is not a priority, but many of the grants and scholarships offered deal with biotechnological techniques.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** approx. $175,000 (84-85)

**TOTAL PERSON-YEARS 85/86:** 0

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|

**COMMENTS:** The above budget figure is taken from the 1984-85 grant list. Most of the projects included deal with genetic characterization and recombinant DNA studies.

Entry Number: 16

**NAME:** MANITOBA HEALTH INDUSTRY DEVELOPMENT INITIATIVE

| | |
|---|---|
| **ADDRESS:** 7th Floor<br>155 Carlton Street<br>Winnipeg, Manitoba<br>R3C 3H8<br><br>**TELEPHONE #:** (204) 945-2471<br>**TELEX #:** 07-587833<br>**CONTACT PERSON:** Reg. Ebbeling<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>Government Branch with a mandate to increase employment in the health care sector in Manitoba. | **RESEARCH FACILITIES**<br><br>**ADDRESS:** N/A<br><br>**TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Industrial stimulation.

- To encourage development of companies who have an objective of applied R&D in biotechnology.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $50,000

**TOTAL PERSON-YEARS 85/86:** N/A

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Support to ABI Biotechnology. | (See above) |

**COMMENTS:**

Entry Number: 17

**NAME:** MANITOBA ENERGY AND MINES, RENEWABLE AND ALTERNATIVE ENERGY

| | |
|---|---|
| **ADDRESS:** 550-330 Graham Avenue<br>Winnipeg, Manitoba<br>R3C 4E3 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** Same |
| **TELEPHONE #:** (204) 945-3417<br>**TELEX #:** 07-55839<br>**CONTACT PERSON:** W.V. Bowerman<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:** Government Department involved in energy management and alternative and renewable Energy. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Technology development, industrial stimulation, product development, regulation & related R&D, process applications.

Industrial processes for the manufacture of fuel alcohols from biomass.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $100,000*

**TOTAL PERSON-YEARS 85/86:** 1.0

*The Fuel Alcohol from Biomass Program has a budget of $1 million but the biotechnology component is relatively small (10%).

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Ethanol from cellulose. | (See above) |

**COMMENTS:**

## ONTARIO

The Ontario government does not have a specific biotechnology policy. Activity in the province is spread throughout a range of departments, with funding coming directly from departmental budgets.

The **Ministry of Industry, Trade and Technology** has appointed a coordinator to develop a consistent approach to biotechnology in the province.

**The Ministry of Natural Resources** is involved in basic research and technology development in the field of regeneration of plantlets from explants of forest conifers.

**The Ministry of Health** is funding the development and evaluation of biotechnology-based applications in health care through the Ministry's unsolicited research grants programmes.

**The Ontario Research Foundation** is very active in biotechnology. They are developing new technology and process applications in the fields of mineral leaching/processing, waste management and fermentation.

**The Ministry of Skills Development**, recognizing the importance of biotechnology to Canada's future, has recently designed an inventory of training modules in the field of biotechnology.

**IDEA Corporation** was dismantled by the Ontario government in early 1986. IDEA provided venture capital investment and innovation assistance in high-technology ventures focusing on the Ontario economy. They assisted biotechnology companies in the formulation of business plans, and had equity investments in the development of potential biotechnology products.

**The Ontario Development Corporation** was involved, along with Labatt's and the Canada Development Corporation, in the start-up of Allelix, a Mississauga-based biotechnology firm. They made a commitment of $18 million for research operations over 10 years as well as a $15 million loan for construction. The ODC maintains a representative on the board of Allelix.

Although no details on the extent of their activity are available at this time, the **Ontario Ministry of Agriculture** supports a significant programme in plant biotechnology at the University of Guelph.

Entry Number: 18

**NAME:** ONTARIO INDUSTRY, TRADE AND TECHNOLOGY, POLICY AND TECHNOLOGY DIVISION

| | |
|---|---|
| **ADDRESS:** 900 Bay Street<br>8th Floor, Hearst Block<br>Toronto, Ontario<br>M7A 2E1 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** N/A |
| **TELEPHONE #:** (416) 963-3721<br>**TELEX #:**<br>**CONTACT PERSON:** Dr. M.F. Walmsley<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:** Government Branch responsible for encouragement and stimulation of innovative enterprises involving new technologies. Science/Development policy. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

This office has taken on the responsibility of coordinating biotechnology activity in Ontario. Dr. Walmsley is one of the two government representatives on the Board of Directors of Allelix, Inc.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** 0

**TOTAL PERSON-YEARS 85/86:** 0

**SPECIFIC PROGRAMMES**

| **DESCRIPTION** | **CONTACT** |
|---|---|

**COMMENTS:**

Entry Number: 19

**NAME:** ONTARIO RESEARCH FOUNDATION

| | |
|---|---|
| **ADDRESS:** Sheridan Park Research Community<br>Mississauga, Ontario<br>L5K 1B3 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** Same |
| **TELEPHONE #:** (416) 822-4111<br>**TELEX #:** 06-982311<br>**CONTACT PERSON:** Dr. John Christison<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>A Provincial Research Organization deriving 85% of its operating budget from contract R&D. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:**<br>Prototype fermenter/purifier.<br>Prototype Rotating Biological Contactors for waste stream treatment. |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Technology development, process applications.

- Ethanol Fermenter/Purifier.
- Mineral Leaching.
- Mineral Processing.
- Fluid Bed Anaerobic Digester.

Activity depends on securing contracts, and is thus variable.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** Unknown ($450,000 in 84/85)

**TOTAL PERSON-YEARS 85/86:** 4.5 (84/85)

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Development of Fermenter/Purifier. | Dr. Lindsay Mulholland |
| Mineral Processing. | Dr. John Christison |
| Anaerobic Digestion. | Mr. Matthew McKim |
| Development of Rotating Biological Contactors for Industrial Streams. | Mr. Matthew McKim<br>(all at above address) |

**COMMENTS:**

Entry Number: 20

**NAME:** ONTARIO DEVELOPMENT CORPORATION

| | |
|---|---|
| **ADDRESS:** 56 Wellesley Street West<br>5th Floor<br>Toronto, Ontario<br>M7A 2E7<br><br>**TELEPHONE #:** (416) 965-4622<br>**TELEX #:** 06-23636<br>**CONTACT PERSON:** D. MacKinnon<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:** Government Crown Corporation which provides counselling service and financial assistance to entrepreneurs in Ontario. | **RESEARCH FACILITIES**<br><br>**ADDRESS:** N/A<br><br>**TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Policy development.

The Corporation has a representative on the Board of Directors of Allelix Inc., representing the interests of the Ontario Government.

Was involved in the initial funding of Allelix Inc. along with Labatt's and the Canada Development Corporation.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $5.7 million (1986) to Allelix Inc.

**TOTAL PERSON-YEARS 85/86:**

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|

**COMMENTS:**

Entry Number: 21

**NAME:** ONTARIO MINISTRY OF HEALTH, POLICY ANALYSIS AND RESEARCH BRANCH

**ADDRESS:** 8th Floor, Hepburn Block
Queen's Park
Toronto, Ontario
M7A 1R3

**TELEPHONE #:** (416) 965-6246
**TELEX #:**
**CONTACT PERSON:** Dr. W. Wigle
**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**
Government Branch which provides support to corporate management for policy development, analysis of health manpower requirements, support for regulation of health disciplines, coordinates research and administers transfer payments for clinical education and to support health R&D.

**RESEARCH FACILITIES**
Public Health Laboratories
**ADDRESS:** N/A
Contact through same address

**TELEPHONE #:**
**TELEX#:**
**CONTACT PERSON:**
**DESCRIPTION:**

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Development and evaluation of biotechnology-based applications in health care.

Support for applied health-related research projects awarded through Ministry unsolicited research grants programmes.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $98,924 to date.

**TOTAL PERSON-YEARS 85/86:** N/A

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Unsolicited research grants programmes. | Pat Stuckless (address above) (416) 965-5887 |

**COMMENTS:** Grants to researchers based at Ontario universities and teaching hospitals.

Entry Number: 22

**NAME:** ONTARIO TREE IMPROVEMENT AND FOREST BIOMASS INSTITUTE

| | |
|---|---|
| **ADDRESS:** Ontario Ministry of Natural Resources<br>Maple, Ontario<br>L0J 1E0 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** Same |
| **TELEPHONE #:** (416) 832-2761<br>**TELEX #:** 06-964589<br>**CONTACT PERSON:** D.P. Drysdale<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:** Government Branch carrying out research and development in forest tree species. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Basic research, technology development.

Regeneration of plantlets from explants of mature and juvenile forest trees.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $115,000

**TOTAL PERSON-YEARS 85/86:** 2.5

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Micropropagation of conifer forest trees. | Rong H. Ho<br>A. Yesoda Raj<br>(Address as above) |

**COMMENTS:**

Entry Number: 23

**NAME:** ONTARIO MINISTRY OF SKILLS DEVELOPMENT

| | |
|---|---|
| **ADDRESS:** Planning and Development Branch<br>3rd Floor, Mowat Block<br>900 Bay Street<br>Toronto, Ontario<br>M7A 1L2 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** N/A |
| **TELEPHONE #:** (416) 965-6327<br>**TELEX #:**<br>**CONTACT PERSON:** D.M. Jennings<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:** Government Ministry - Review and evaluation of skills development policies and initiatives. College curriculum development. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

- Educational initiatives.

Development of an inventory of training modules in the form of performance objectives and associated criteria and to identify a common core curriculum for occupations in the field of biotechnology. Also develops training modules in the following areas:
- biomass
- biomedicine
- agriculture.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $16,275

**TOTAL PERSON-YEARS 85/86:** N/A

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| See above activities | |

**COMMENTS:** The Biotechnology curriculum was developed on contract by Algonquin College. There is a Steering Committee with representatives from the following community colleges: Algonquin
Seneca
Centennial.

Entry Number: 24

**NAME:** IDEA CORPORATION

| | |
|---|---|
| **ADDRESS:** 33 Yonge Street<br>Suite 800<br>Toronto, Ontario<br>M5E 1V3 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** N/A |
| **TELEPHONE #:** (416) 362-4400<br>**TELEX #:** 06-217627<br>**CONTACT PERSON:** I. Krizancic<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>Government Crown Corporation supplying venture capital investment and innovation assistance in hi-tech ventures focusing on Ontario's economy. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Industrial stimulation.

Venture capital investment in biotechnology based companies and financial support for commercially attractive R&D projects in all important areas of biotechnology.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $300,000 - 400,000

**TOTAL PERSON-YEARS 85/86:** 1.0

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Cardiovascular drug (Cardionatrin) that may be produced commercially by biotechnological processes. | H. Langstaff (address above) |
| Fermtech - business plan. | |

**COMMENTS:** IDEA Corporation was dismantled by the Ontario government in early 1986.

## QUÉBEC

The Government of Québec in 1982 committed $30 million over a period of 5 years for biotechnology in the province. Four provincial crown corporations have been created to carry out this commitment.

**BIO-AGRAL** provides equity capital for companies in the agri-food industries. To date they have not invested in any biotechnology firms.

**AQVIR** provides venture captial to innovative small businesses. They also have not funded any activity in biotechnology.

**CRIQ** (Centre de Recherche industrielle du Québec) is the provincial research organization. They have a well-developed biotechnology programme, with an emphasis on fermentation technology.

The Québec government has committed $14 million over 5 years to **Le Centre Québécois de valorisation de la biomasse** for work on biomass conversion. They have recently opened a fermentation facility.

In addition to its biotechnology strategy commitments, the government has supported the formation of **BIOMEGA.** There has been a commitment of $47 million over 5 years to this firm, which works in the health care field.

Entry Number: 25

**NAME:** MINISTÈRE DE L'ENSEIGNEMENT SUPÉRIEUR, DE LA SCIENCE ET DE LA TECHNOLOGIE (QUÉBEC)

| | |
|---|---|
| **ADDRESS:** 875, Grande Allée est<br>3e étage, Edifice H<br>Québec (Québec)<br>G1R 4Y8 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** N/A |
| **TELEPHONE #:** (418) 643-5570<br>**TELEX #:**<br>**CONTACT PERSON:** Georges Lagacé<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>Government Ministry responsible for universities, science and technology in the province. Has both a policy and a funding/coordination role. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Policy, industrial development/stimulation.
The Québec government has a well defined strategy for biotechnology, outlined in the document "À l'Heure des Biotechnologies". Three sectors are highlighted: agri/food; forestry/biomass; and health care.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $6 million *

**TOTAL PERSON-YEARS 85/86:** 3.0 **

*Represents the entire funding commitment for the province which is distributed to various agencies within the province.

**Includes only the personnel employed by this Ministry and not those employed by the Agencies receiving funding.

**SPECIFIC PROGRAMMES**

| DESCRIPTION | | CONTACT |
|---|---|---|
| Bio-Agral | - Equity capital for the agri-food industry. | |
| AQVIR | - Venture capital for innovative small businesses. | |
| CRIQ | - Provincial research organization. Major involvement in manure fermentation. | |
| Québec Biomass Centre | - Biomass conversion/fermentation. | |

**COMMENTS:**

## NEW BRUNSWICK

Biotechnology activity in New Brunswick is concentrated at the **Research and Productivity Council.** They are active on two fronts, plant tissue culture/micropropagation for tree improvement, and aquaculture. The **Energy Secretariat** is monitoring developments in biotechnology in the field of alternate energy. The **Department of Commerce and Technology** is currently developing policy related to biotechnology and is responsible for planning and coordinating such S&T activities in the province.

Entry Number: 26

**NAME:** NEW BRUNSWICK DEPARTMENT OF COMMERCE AND TECHNOLOGY

| | |
|---|---|
| **ADDRESS:** Box 6000<br>Fredericton, New Brunswick<br>E3B 5H1 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** N/A |
| **TELEPHONE #:** (506) 453-2489<br>**TELEX #:** 014-46100<br>**CONTACT PERSON:** D.F. Clarke<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>Government Department involved in the stimulation of economic growth and development in New Brunswick. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Policy development, industrial stimulation.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** 0

**TOTAL PERSON-YEARS 85/86:** 0.1

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| None to date. | |

**COMMENTS:** There is interest in biotechnology, and the support/stimulation mechanisms are in place. They are cooperating with the Research and Productivity Council in monitoring the potential of biotechnology.

Entry Number: 27

**NAME:** NEW BRUNSWICK RESEARCH AND PRODUCTIVITY COUNCIL

| | |
|---|---|
| **ADDRESS:** Box 6000<br>College Hill Road<br>Fredericton, New Brunswick<br>E3B 5H1 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** Same |
| **TELEPHONE #:** (506) 452-8994<br>**TELEX #:** 014-456115<br>**CONTACT PERSON:** Dr. Charles J. Wiesner<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:** RPC is a provincial research organization providing industrial research and development on a non-profit fee-for-service basis. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Technology development.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $70,000

**TOTAL PERSON-YEARS 85/86:** 1.65

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Micropropagation/plant tissue culture. | Dr. Charles J. Wiesner |
| Aquaculture. | Dr. B. Bacon |

**COMMENTS:** Biotechnology budget is expected to increase to $200,000 - $500,000 p.a., pending decision on changes to the S&T sub-agreement with the federal government. New initiatives would be in forest and agricultural biotechnology as well as aquaculture.

Entry Number: 28

**NAME:** NEW BRUNSWICK ENERGY SECRETARIAT

| | |
|---|---|
| **ADDRESS:** Box 6000<br>Fredericton, New Brunswick<br>E3B 5H1 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** N/A |
| **TELEPHONE #:** (506) 453-3897<br>**TELEX #:** 014-46230<br>**CONTACT PERSON:** Darwin B. Curtis<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>Government Branch involved in provincial energy policy and development, demonstration and technology transfer for all conservation and renewable energy energy technologies across the province. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Technology development, industrial stimulation, educational initiatives, policy development.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** 0*

**TOTAL PERSON-YEARS 85/86:** 0*

*There is a budget of $230,500 and 2.5 PY's for the Bioenergy programme, which is spent on wood residue energy.

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Bioenergy Programme. | D.B. Curtis |

**COMMENTS:** The Secretariat has received several proposals for the production of biogas from available digestion processes, but the projects were never undertaken. They are monitoring the field and will take advantage of the technologies as they are developed.

## NOVA SCOTIA

The **Nova Scotia Research Foundation Corporation** is one of the major centres of biotechnology R&D in the Maritimes. They are involved in technology and product development in support of industry. Their work is in the fields of mycorrhizae for agriculture and forestry and in the breakdown of wood to useful products.

The **Nova Scotia Agricultural College** provides agricultural education for the Maritime provinces. The college is presently supporting work in tissue culture and screening for stress tolerant plant strains. They have plans to expand their activity in plant biotechnology should the funding be approved.

The **Nova Scotia Department of Development** administers a variety of programmes that could be exploited by biotechnology firms. The provincial approach to biotechnology is beginning to take shape with the funding of the Atlantic Institute of Biotechnology and the Department of Development is expecting to be able to develop specific plans for dealing with biotechnology on this basis.

The **Atlantic Institute of Biotechnology** is a joint venture of Dalhousie University, the Technical University of Nova Scotia, the Nova Scotia Agricultural College and the Nova Scotia Research Foundation Corporation, funded by the federal Department of Regional Industrial Expansion. Its purpose is to encourage cooperation and strengthen communications between the technology developers (the universities) and the technology users (industry).

Entry Number: 29

**NAME:** NOVA SCOTIA RESEARCH FOUNDATION CORPORATION

| | |
|---|---|
| **ADDRESS:** Box 790, 100 Fenwick Street<br>Dartmouth, N.S.<br>B2Y 3Z7 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** Same |
| **TELEPHONE #:** (902) 424-8670<br>**TELEX #:** 019-22719<br>**CONTACT PERSON:** Dr. K. Hellenbrand<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>Provincial Research Organization which assists economic development by promoting, stimulating and encouraging the effective use of science and technology by government and industry. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Technology development, product development, industrial stimulation.

Straw fermentation for ruminant food stock.

Mycorrhizal inoculum for agricultural crops and tree seedlings.
- Increasing efficiency of nutrient and water intake.
- Resistance against soil-borne diseases.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $160,000

**TOTAL PERSON-YEARS 85/86:** 5.0

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Mycorrhizae of agriculture crops. | W. Robertson |
| Mycorrhizae of forest trees. | D. Boyle |
| Microbial and enzymatic modification of lignocellulosic materials. | A. Reade<br>(All at NSRFC as above) |

**COMMENTS:**

Entry Number: 30

**NAME:** NOVA SCOTIA DEPARTMENT OF DEVELOPMENT

**ADDRESS:** Business and Technical Services Division
1800 Argyle Street, Box 519
Halifax, Nova Scotia
B3J 2R7

**TELEPHONE #:** (902) 424-3971
**TELEX #:** 019-22548
**CONTACT PERSON:** Jim Simpson
**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**
Government department providing advice and assistance to business in the province.

**RESEARCH FACILITIES**

**ADDRESS:** N/A

**TELEPHONE #:**
**TELEX #:**
**CONTACT PERSON:**
**DESCRIPTION:**

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Policy development, industrial stimulation.

The approach to enhancing biotechnology development in Nova Scotia is still in its formative stages. A recent endeavour to focus resources in this regard is the establishment of the Atlantic Institute of Biotechnology with its mandate to assist in the development of the biotechnology capabilities in Nova Scotia industry.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** 0

**TOTAL PERSON-YEARS 85/86:** 0

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| None | |

**COMMENTS:** There are many business development programmes that could be applied to biotechnology businesses.

Entry Number: 31

**NAME:** NOVA SCOTIA AGRICULTURAL COLLEGE

| | |
|---|---|
| **ADDRESS:** Box 550<br>Truro, Nova Scotia<br>B2N 5E3 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** Same |
| **TELEPHONE #:** (902) 895-6497<br>**TELEX #:** 019-34532<br>**CONTACT PERSON:** Dr. H.F. MacRae<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>Providing agriculture education (Degree and Diploma) and agricultural research for the four Atlantic provinces. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Educational initiatives, basic research.
- Plant strain development, plant propagation.
- Introductory course on plant biotechnology.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $50,000

**TOTAL PERSON-YEARS 85/86:** 1.5

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Sexual reproduction of flowering plants with and without gynoecial mediation. | (See above) |
| Screening for cold stress tolerant forage legumes using *in vitro* techniques; germplasm preservation. | |
| Screening for water stress and heat stress tolerance in potato varieties. | |
| Freezing tolerance in White Clover. | |
| Carbon/nitrogen efficiency in Alfalfa. | |

**COMMENTS:**

## PRINCE EDWARD ISLAND

Biotechnology is gaining importance in P.E.I. but at the present time relatively little R&D activity is occurring. **The P.E.I. Energy Corporation** is interested in new forms of renewable energy. Only one of their programmes, the fermentation of potato processing wastes for the generation of methane gas for electrical production, is related to biotechnology. Subsequent to a study carried out by a consultant, a $3.4 million facility is currently being constructed at Cavendish Farms in New Annan. The **P.E.I. Development Agency** is actively promoting industrial biotechnology development in the private sector. Funding is available in many forms for the establishment of new businesses or the marketing of new products produced in the province. **P.E.I. Agriculture** has two biotechnology projects. One involves embryo transfer in swine while the other involves tissue testing and culture in potatoes. Their primary role is to provide technical services and field demonstrations of new biological farming techniques.

Entry Number: 32

**NAME:** PRINCE EDWARD ISLAND DEVELOPMENT AGENCY

| | |
|---|---|
| **ADDRESS:** West Royalty Industrial Park<br>Charlottetown,<br>Prince Edward Island<br>C1E 1B0 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** N/A |
| **TELEPHONE #:** (902) 566-4222<br>**TELEX #:** 014-44109<br>**CONTACT PERSON:** Cathy Carmody<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>Government funded agency devoted to the stimulation of economic development through support of business and industry. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Product development, industrial stimulation, policy development.
- Drafting a provincial science and technology strategy.
- Funding is available for business and industrial development.
- Biotechnology has been identified as a priority activity for policy development.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** N/A

**TOTAL PERSON-YEARS 85/86:** N/A

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| None | |

**COMMENTS:** This agency is actively promoting biotechnology in P.E.I. The major thrusts are in aquaculture-related biotechnology and agriculture (especially potatoes).

Entry Number: 33

**NAME:** PRINCE EDWARD ISLAND DEPARTMENT OF AGRICULTURE

| | |
|---|---|
| **ADDRESS:** P.O. Box 1600<br>Charlottetown,<br>Prince Edward Island<br>C1A 7N3 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** P.O. Box 1600<br>Charlottetown, P.E.I.<br>C1A 7N3 |
| **TELEPHONE #:** (902) 892-5465<br>**TELEX #:** 014-4415<br>**CONTACT PERSON:** Awni T. Raad<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>Government Department responsible for information and technical services to the province's farmers. Field demonstrations. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Technology development, technology transfer.
Specific interests are tissue testing and nutrition of potatoes and embryo techniques for swine farming.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $97,100

**TOTAL PERSON-YEARS 85/86:** 2.75

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Tissue testing and nutrition of potatoes. | Richard Veinot |
| Embryo techniques in swine. | Dr. Timothy Ogilvie |
| Microbiology services. | James Bryenton<br>(all at above address) |

**COMMENTS:**

Entry Number: 34

**NAME:** PRINCE EDWARD ISLAND ENERGY CORPORATION

| | |
|---|---|
| **ADDRESS:** P.O. Box 2000<br>Charlottetown,<br>Prince Edward Island<br>C1A 7N8 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** N/A |
| **TELEPHONE #:** (902) 892-1051<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**<br>Provincial Crown Corporation working to develop and promote energy systems on an economic and efficient basis. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Industrial stimulation, process applications.

Will provide funding for one of a kind energy demonstration projects (Renewable Energy Initiatives Program).

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** Approx. $30,000

**TOTAL PERSON-YEARS 85/86:** N/A

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Production of butanol from waste agricultural products. | (See above) |
| Utilization of potato processing wastes by bulk volume fermentation for the generation of methane gas. | |

**COMMENTS:** Usual funding is 1/3 of capital cost plus all costs for evaluation and technology transfer. The funding is usually in response to unsolicited proposals in the alternative energy field.

## NEWFOUNDLAND

Biotechnology is receiving increasing attention in Newfoundland. The majority of the provincial government activity is at the Department of Fisheries in the field of aquaculture. Approximately 50% of the $294,000 spent on aquaculture in 1985/86 was for biotechnology related research activity. As well, the Department of Fisheries is going to participate in a study to determine the potential of fermentation of fish waste and potatoes to produce high protein animal feed.

The department of Agriculture has also committed funds to the above project. In addition, the provincial government funds research into biotechnology at Memorial University.

There is a limited amount of forest-related biotechnology research being done by the Department of Forest Resources and Lands.

The Department of Development and Tourism has been the contact point with the National Biotechnology Advisory Committee. The department is monitoring progress in biotechnology, and is attempting to evaluate its potential benefits to the province. As well, the department provides grants which could be used for studies related to biotechnology.

Entry Number: 35

**NAME:** NEWFOUNDLAND AND LABRADOR DEPARTMENT OF FOREST RESOURCES AND LANDS

| | |
|---|---|
| **ADDRESS:** Box 2006<br>Herald Building<br>Corner Brook, Newfoundland<br>A2H 6J8 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** Contact through head office. |
| **TELEPHONE #:** (709) 637-2285<br>**TELEX #:**<br>**CONTACT PERSON:** G.K. Ross<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:** Government Department responsible for silviculture, management, inventory, roads and protection of Newfoundland and Labrador provincial forests. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Basic research, technology development.

Forest genetic research.

Forest productivity research.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $199,840 *

**TOTAL PERSON-YEARS 85/86:** Not available.

*This figure represents the entire silviculture research budget. It was not possible to specify how much was for biotechnology.

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|

**COMMENTS:**

Entry Number: 36

**NAME:** NEWFOUNDLAND & LABRADOR DEPARTMENT OF FISHERIES

**ADDRESS:** Dept. of Fisheries
Fisheries Technology Division
5th Floor
Confederation Building Complex
St. John's, Newfoundland
A1C 5T7

**TELEPHONE #:** (709) 576-3726
**TELEX #:**
**CONTACT PERSON:** Brian Meany
**TYPE OF ORGANIZATION AND OVERALL FUNCTION:**
Provides consulting services to fishing industry regarding production management systems, productivity, quality control and technology transfer.

**RESEARCH FACILITIES**

**ADDRESS:**

**TELEPHONE #:**
**TELEX #:**
**CONTACT PERSON:**
**DESCRIPTION:**

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Aquaculture.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $147,000 **86/87:** $211,000

**TOTAL PERSON-YEARS 85/86:** N/A

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Various projects related to mussel farming, Arctic char, salmon, scallop and cod fish culture. | (See above) |

**COMMENTS:** Includes $50,000 grant to Memorial University's Marine Sciences Laboratory.

Entry Number: 37

**NAME:** NEWFOUNDLAND & LABRADOR DEPARTMENT OF FISHERIES

| | |
|---|---|
| **ADDRESS:** Dept. of Fisheries<br>5th Floor<br>Confederation Building Complex<br>St. John's, Newfoundland<br>A1C 5T7 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** |
| **TELEPHONE #:** (709) 576-2538<br>**TELEX #:**<br>**CONTACT PERSON:** John Dutton<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:** | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Fermentation.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** 0 **86/87:** $20,000

**TOTAL PERSON-YEARS 85/86:**

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Participation in a study to determine the potential of fermentation of fish and potatoes to produce high protein animal feed. | (See above) |

**COMMENTS:** See entry number 38, Department of Rural Agriculture and Northern Development.

Entry Number: 38

**NAME:** NEWFOUNDLAND & LABRADOR DEPARTMENT OF RURAL AGRICULTURAL AND NORTHERN DEVELOPMENT

| | |
|---|---|
| **ADDRESS:** Dept. of Agriculture<br>Production & Market Planning<br>Provincial Agriculture Building<br>Brookfield Road<br>P.O. Box 4750<br>St. John's, Newfoundland<br>A1C 5T7 | **RESEARCH FACILITIES**<br><br>**ADDRESS:** |
| **TELEPHONE #:** (709) 576-3840<br>**TELEX #:**<br>**CONTACT PERSON:** Philip McCarthy<br>**TYPE OF ORGANIZATION AND OVERALL FUNCTION:** Involved in crop and livestock production and special projects. | **TELEPHONE #:**<br>**TELEX #:**<br>**CONTACT PERSON:**<br>**DESCRIPTION:** |

**DESCRIPTION OF BIOTECHNOLOGY ACTIVITIES AND/OR POLICIES:**

Fermentation.

**TOTAL BIOTECHNOLOGY BUDGET 85/86:** $5,000 **86/87:** $25,000

**TOTAL PERSON-YEARS 85/86:** 0

**SPECIFIC PROGRAMMES**

| DESCRIPTION | CONTACT |
|---|---|
| Contribution to a study in the fermentation of fish meal and potatoes to produce high protein domestic animal feed. | (See above) |

**COMMENTS:** See entry number 37, Department of Fisheries.

# APPENDIX C

## MOSST INVENTORY OF BIOTECHNOLOGY ACTIVITY

## IN PROVINCIAL ORGANIZATIONS

The following questionnaire was circulated in July, 1985 to all agencies in each province that indicated (in a telephone survey) that they were involved in biotechnology.

## MOSST INVENTORY OF

## BIOTECHNOLOGY ACTIVITY IN PROVINCIAL ORGANIZATIONS

In support of the National Biotechnology Strategy, the Ministry of State for Science and Technology (MOSST) is gathering information on biotechnology activities in the provinces. By surveying research performers, funding agencies, policy organizations and technology users, MOSST would like to compile an inventory of:

1. Biotechnology Strategies and Policy Structures;
2. Major Biotechnology R&D Activities;
3. Budgets and Expenditures;
4. Human Resources; and
5. Education and Training Programs and Opportunities.

Such an inventory would include groups and organizations involved both directly in biotechnnology and in the related provincial regulatory and industrial development efforts, and would be of value in better understanding the pattern and extent of biotechnology developments.

1. Biotechnology Strategies and Policy Structures

i) Name of Organization:

Address:

Major Contact Person:

Phone Number:

Telex Number:

Please give a brief outline of your organization's overall function:

ii) Mark any of the following categories that describe your Agency/Branch and if possible indicate which is the most accurate.

a) A government ministry or branch
b) A provincial research organization
c) A provincial government-funded agency
d) A joint government-industry agency
e) A joint federal-provincial agency
f) other (please specify)

iii) Does your agency/branch have a stated biotechnology policy, strategy or mandate? (What is it?)

iv) Does your agency/branch set policy for any other provincial organizations? (Which ones?)

v) Does your agency/branch work under a policy set by another organization or level of government? (Which ones?)

vi) If your agency/branch performs R&D, what is the structure which provides scientific/program guidance? (Mark any that are applicable, and indicate which takes priority.)

a) Internal advisory board or committee
b) Industry board of directors
c) Provincial science board
d) Peer review
e) Other (please specity)

vii) Which of the following information exchange mechanisms do you use? With what sectors/agencies do you most often exchange information?

a) Meetings/seminars
b) Conferences/workshops
c) Joint federal/provincial programs or projects
d) Joint government/industry programs or projects
e) Joint government/academic programs or projects
f) Other (please specify)

2. Major Biotechnology Activities

i) Of the following activities, please mark any in which you are involved and if possible rank them according to their level of activity.

a) Basic research
b) Technology development
c) Process applications
d) Product development
e) Regulation and/or related R&D
f) Industrial development/stimulation
g) Educational initiatives for biotechnology
h) Policy development
i) Other (please specify)

ii) In reference to the above categories, could you please specify your main activities, give a short outline of what each program involves, and, if possible indicate the "industrial" application of the program.
(Expand on a separate piece of paper if necessary)

iii) For your agency/branch, is biotechnology

a) Your primary activity?
b) An important secondary activity?
c) A minor interest?
d) One of several major activities?

iv) Do you anticipate any significant changes in your level of activity in biotechnology? If so, what specific areas of biotechnology have you targeted for future study, and what level of funding can/do you expect?

3. Budgets and Expenditures

Table 1 has been included to help you summarize the answers to the following questions (Do not include rent and utility costs, and please note any facility or fit-out costs or special capitalization separately):

i) What were your expenditures on biotechnology-related programs for the 84/85 fiscal year?

ii) What is the budgeted expenditure for 85/86, and do you expect it to increase for 86/87?

iii) How do the above figures compare with expenditures for 81/82 and/or 82/83?

iv) For how many years have you had a specific biotechnology budget?

v) How much of your budget has come from sources other than the provincial government?

a) Federal government
b) Industry
c) Other (please specify)

TABLE 1 - BIOTECHNOLOGY BUDGETS

| YEAR | EXPENDITURES | SOURCE OF REVENUES | | | |
|---|---|---|---|---|---|
| | Total $ | Provincial $ | Federal $ | Industry $ | Other $ |
| Year of first expenditure ( ) | | | | | |
| 81/82 | | | | | |
| 82/83 | | | | | |
| 83/84 | | | | | |
| 84/85 | | | | | |
| 85/86 | | | | | |
| Projected 86/87 | | | | | |

(vi) - ix) expand on a separate piece of paper if necessary)

vi) How much of your 84/85 revenues came from contracts?

| AGENCY | PROJECT | DURATION | REVENUES |
|---|---|---|---|

vii) How much of your 84/85 biotechnology expenditures was for contracts? for grants?

viii) With whom and for what purpose have <u>contracts</u> been made?

| CONTRACTOR | PROJECT | DURATION | COST |
|---|---|---|---|

ix) To whom and for what purpose have <u>grants</u> been made?

| BENEFICIARY | PROJECT | DURATION | COST |
|---|---|---|---|

x) With reference to the following categories, please give an estimate of the percentage of your biotechnology expenditure for the 84/85 fiscal year.

| FIELD | APPLICATION | EST % of 84/85 EXPENDITURES |
|---|---|---|
| 1. Agriculture | a) Livestock | ____ |
| | b) Plants | ____ |
| 2. Forestry | a) Trees | ____ |
| | b) Products | ____ |
| 3. Health Care | a) Animal | ____ |
| | b) Human | ____ |
| 4. Food & Beverage | a) Products | ____ |
| | b) Waste Processing | ____ |
| 5. Mineral Resources | a) Mineral Leaching | ____ |
| | b) Hydrocarbon Recovery | ____ |
| | c) Waste Products | ____ |
| 6. Waste Treatment | a) Municipal | ____ |
| | b) Industrial | ____ |
| 7. Chemicals and Alternate Energy | a) Specialty Chemicals | ____ |
| | b) Bulk Chemicals | ____ |
| | c) Enzymes | ____ |
| 8. Support Technology | a) Downstream Processing | ____ |
| | b) Fermentation/Scale-up | ____ |
| | c) Other (please specify) | ____ |
| 9. Other (Please Specify) | | ____ |

4. Human Resources

Table 2 has been included to help you summarize the answers to the following questions:

i) How many person-years are involved directly in biotechnology projects?

ii) How many of these positions are:

a) scientific?
b) engineering?
c) technical support?
d) graduate students?
e) administrative support?
f) managerial?
g) marketing?
h) policy?
i) other?

TABLE 2 - HUMAN RESOURCES

| CATEGORY | 85/86 PERSON-YEARS | Projected 86/87 PERSON-YEARS |
|---|---|---|
| Scientific | | |
| Engineering | | |
| Technical Support | | |
| Graduate Student | | |
| Administrative Support | | |
| Managerial | | |
| Marketing | | |
| Policy | | |
| Other | | |
| TOTAL | | |

iii) Please complete Table 3 with reference to your main biotechnology activities listed in 2 ii).

TABLE 3 - MAIN BIOTECHNOLOGY ACTIVITIES

(Expand on a separate piece of paper if necessary)

| PROGRAM / PROJECT | CONTACT PERSON (Name, Address, Phone) | BUDGET $ 85/86 | HUMAN RESOURCES (Person-Years) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sci. | Eng. | Tech. Supp. | Grad. Stud. | Admin Supp. | Mgr. | Mktg. | Policy | Other | TOTAL |
| | | | | | | | | | | | | |

5. Education and Training Programs and Opportunities

i) Are you presently, or do you anticipate, recruiting more scientific or technical personnel for your biotechnology programs?

ii) In what specific qualifications and fields are you interested?

iii) Have you recently sent any of your scientific or technical personnel on biotechnology-oriented training sessions? (Where were these courses, and what specific skills/fields did they involve?)

iv) Are you involved in Academic Curriculum Planning with respect to biotechnology? (Please explain your involvement, especially in respect to policy and curriculum content.)

Thank you for taking the time to answer these questions. If you have any further information that would be of assistance in compiling this inventory, please include it. If your agency publishes an annual report, please include a copy.

For further information regarding this survey, please contact Laird Roe, MOSST, at (613) 990-6261, Telex #0534123, Answer Back: CDA IEO TT.

Please return the questionnaire before August 2, 1985 to:

Provincial Biotechnology Inventory
Ministry of State for Science and Technology
8th Floor, West Tower
235 Queen Street
Ottawa, Ontario
K1A 1A1

## APPENDIX D

## PROVINCIAL AND TERRITORIAL BIOTECHNOLOGY CONTACTS

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